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SERIES A: AGRICULTURAL.

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Emergency Entomological Service.—*Entom. News, Philadelphia*, xxviii, no. 8, October 1917, pp. 375–377.

Reports of the Emergency Entomological Service of the United States Department of Agriculture record new legislation in Illinois whereby the Department of Agriculture has authority to compel owners or other occupiers of property infested by insect pests or plant diseases to take measures to arrest or prevent such damage under penalty of a fine. An insect pest survey and information service is established under the New York Food Supply Commission, and a similar survey in Ohio. Farm demonstrators are to work in practically every county in New Jersey and in Tennessee. In Mississippi a systematic educational campaign in preparation for winter spraying is to be designed by proclamation of the governor.

The Food Production Act appropriates about £88,000 for the prevention, control and eradication of insects and plant diseases injurious to agriculture and the conservation and utilisation of plant products. Of this nearly £30,000 is allotted to the Bureau of Entomology. The expenditure is to begin with an extensive autumn campaign against the Hessian fly [*Mayetiola destructor*] and attempted control on a large scale of the insects injurious to stored grain and other products. Winter work will include dormant tree spraying and fumigation of citrus trees.

DUBOIS (P.). **La Lentille.** [The Lentil.]—*La Vie Agric. et Rur., Paris*, vii, no. 42, 20th October 1917, pp. 289–290.

The cultivation of lentils is threatened, and in Lorraine has been abandoned, owing to the attacks of a species of *Bruchus*. The insects can be killed by placing the infested seeds in a barrel, pouring in 20-25 c.c. carbon bisulphide and immediately closing the bung, allowing them to remain in contact with the fumes for 24 hours; the barrel should be turned several times to render the contact more intimate. The adults may also be induced to leave the seeds by exposing them to a gentle heat, and precautions must be taken against sowing infested seed to prevent the further spread of this pest.

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VAN DER GOOT (P.). **Het Tephrosia-Kevertje.** [The small Tephrosia Beetle.]—*Meded. v. h. Proefstation Midden-Java, Salatiga,* no. 26, 1917, 36 pp., 1 fig. 2 plates.

In the plantations at higher elevations in Java there has been of late years a great advance in the cultivation of green manure plants, of which *Tephrosia candida* is one of the most satisfactory. In view of its increasing importance, the considerable injury done to it by the Tephrosia beetle led to an investigation on the latter being undertaken.

The identity of this Anthribid is somewhat doubtful. European entomologists have identified the examples submitted to them as *Araecerus fasciculatus,* De G., but the literature on this species almost exclusively describes it as living in stored vegetable products. In Java Zehntner observed it in stored coffee beans and dealt with it at length under the name of "coffee weevil." It is therefore remarkable that while the Tephrosia beetle readily breeds in the pods of plants with Papilionaceous flowers, it refuses to do so in such products as coffee and cacao beans. These pronounced differences in their life-history would appear to warrant two distinct biological races of *A. fasciculatus* being recognised. Excepting for a note by F. H. Chittenden (Some little-known insects affecting stored vegetable products—U.S. Dept. Agric., Bull. No. 8, n. series, 1898), recording *A. fasciculatus* from the pods of *Cassia occidentalis* and the seeds of *Indigofera* sp., it has never been mentioned as an important pest of Leguminosae.

After a brief description of this beetle, notes on its general biology are given. In the case of *Tephrosia candida* the eggs are laid in the semi-ripe or almost ripe pods—when the seeds are already swollen. Oviposition was not observed, but the beetle apparently gnaws a hole into which it thrusts its ovipositor. In the pods of *T. candida,* the hole is usually in the lower seam, sometimes in the upper one, but never in the sides. A single egg is deposited in each hole, close to a seed. The number of holes seldom exceeds that of the seeds and is rarely more than fourteen per pod. The egg-stage lasts only about 6–7 days. The young larva immediately begins to bore into the adjacent seed and often attacks a second one without completely eating the first. The skin of the seed is also destroyed, so that the larva is nearly always distinctly visible when an infested pod is opened. The larval period lasts about 23–29 days. After a pupal period of 7 or 8 days the adult remains for about six days within the pod, finally emerging through a round hole, about $\frac{1}{12}$ inch in diameter, gnawed in one of the sides. As the egg is usually laid in semi-ripe pods the beetle emerges before the pods open. A premature opening may be fatal to any larvae or pupae within by causing them to fall to the ground. The beetle at once begins to gnaw the adjoining old or young pods; mating takes place after a few days and oviposition soon follows, about 11–13 days after emergence. Usually one egg is laid per day; the maximum observed was three. The average number of eggs per female is twenty-nine, with an observed maximum of eighty-four. Oviposition lasts for about twenty-five days. There are 6 or 7 annual generations. The beetles died within fourteen days when deprived of food. The average life of a female beetle is thirty-eight days, with an observed maximum of sixty-four. The average life of a

male was forty-eight days, with a maximum of ninety-one. The food of the adult beetle consists of practically any vegetable matter, with a preference for softer substances such as the pods of *Tephrosia*, *Crotalaria*, *Leucaena glauca*, *Cassia* and other Leguminosae, coffee beans, cacao beans, etc. The beetles seem capable of flying considerable distances, flights of about 1,000 yards being believed to occur. Light exercises a great attraction. When disturbed the beetles drop and feign death, so that under natural conditions it is difficult to collect them in large numbers.

The injury to *T. candida* is sometimes very serious; in one case only 25 per cent. of the seeds escaped damage, and in another, only 5 per cent. Up to the present only plants with Papilionaceous flowers have been attacked. *Crotalaria striata* is believed to be the original host-plant, though *T. candida* is the principal one, other food-plants being *Glycine soja* and *Indigofera* sp. *Cassia occidentalis* cannot be regarded as a true food-plant, as full development appears seldom to take place in it. The seeds of *T. vogeli* remain immune from attack even if this plant is grown among seriously infested *T. candida*. The pods, however, are pierced with holes for oviposition, so that development appears to be hindered within them; only in a few instances were small larvae found and these had not done more than gnaw the surface of the seeds, probably because the latter ripen and harden rapidly. In the open *Leucaena glauca* does not appear to suffer, and while beetles in captivity oviposit in the almost ripe pods of this plant, the resultant larvae do not develop. *Phaseolus radiatus*, *Sesbania aegyptiaca* and *Vigna catjang* do not appear to be attacked.

An investigation was made of the vegetable substances (other than the living plants mentioned above) in which development seemed likely. While Zehntner has recorded the coffee weevil as completing its development in coffee beans, the Tephrosia beetle does not even oviposit in them. In unfermented cacao beans (which are also suited to the development of the coffee weevil) the Tephrosia beetle develops rarely, if ever. The author was unable to ascertain whether the coffee weevil attacks the pods of *Tephrosia*, but the above facts make the biological identity of these two insects very doubtful. The larvae of the Tephrosia beetle were able partially to develop in damp (stored) seed of *T. candida* and completely in very damp, mouldy seed of *Glycine soja* and *Vigna catjang*, but no development was noticed in the dry seed of these plants. Larvae were noticed in the unripe seed of *Sesbania aegyptiaca*, but neither eggs nor larvae in the ripe seed of *Leucaena glauca* or *Tephrosia vogeli*. It thus appears that the Tephrosia beetle oviposits only in the ripe seed of plants with Papilionaceous flowers and then only when it is in a damp condition, and that full development occurs only in the seeds of *G. soja* and *V. catjang*, these being of sufficient size to permit it.

Four Hymenopterous parasites of the Tephrosia beetle are of common occurrence. They include the Chalcids, *Aximopsis javensis*, Gir., and *Eupelmus javae*, Gir., and two Braconids not yet identified. Brief descriptions and biological notes are given of these parasites, which are of only slight importance in checking the pest.

There are four ways in which new plantings of *T. candida* may become infested: Through the seed, from adjacent vegetable substances,

from neighbouring wild Leguminosae, and from older plants of *T. candida*, either growing among the new plants or growing close by. Infestation through the seed is not a serious source of danger; very few beetles will be found in the harvested seed and they will have perished long before the new plants become susceptible to attack—at the time that they flower, *i.e.*, when they are about 8–10 months old. There is a possibility that such beetles may fly to wild Leguminosae (*Crotalaria*) or to *T. candida* growing in the vicinity, but before infestation from such sources can reach the new plants the latter will probably have been infested by other means. No precautions need therefore be taken when harvesting the seed of *T. candida*. Infestation from adjacent vegetable substances cannot occur in nature; it has already been stated that the sole substances involved are the damp seeds of a few leguminous plants and such seeds are not found under natural conditions. Attack by beetles flying from wild Leguminosae, chiefly *Crotalaria striata*, seems to be the principal cause of land planted for the first time with *T. candida* becoming infested. The destruction of neighbouring plants of *C. striata* is therefore advised, though as the beetles may come from some distance, this measure is not entirely efficacious. While the first attack among newly-planted *T. candida* is due to these individuals from *C. striata*, the infestation is maintained either by the new plants themselves or by other *T. candida* growing near-by. When about ten months old, *T. candida* remains in flower, so that the beetle has ample opportunities for breeding, and if the plants are allowed to bear fruit undisturbed for some months, the seed-crop will be entirely destroyed.

As regards remedial measures, a thorough pruning provides a successful means of combating the pest. Collection of the beetles is not a feasible procedure, but if the plants are sprayed with a poison, the adults will be killed. When pod-bearing twigs were sprayed with a one per thousand solution of Paris green, 75 per cent. of the beetles on them died within six days. *Dolichoderus bituberculatus* (black cacao ant) has proved useless as a check. Another method is the simultaneous removal from the trees of every pod susceptible to attack or already infested. By keeping the plants free from semi-ripe pods for a sufficiently long period the beetle disappears. Experiments show that if vigorous plants, more than a year old, are pruned of all pods, flowers and flower-clusters, a period of seventy days elapses before semi-ripe pods are again present, while an even more thorough pruning naturally results in a still longer interval. When oviposition is possible, the female beetle has an average life of thirty-eight days, with a maximum of sixty-four; if there are no opportunities for oviposition the maximum rises to eighty-one days—the average remaining unaltered. If therefore all pods are removed, the only individuals left will consist of a few newly-emerged adults and of a majority of older ones. As no opportunity for oviposition is afforded these will be nearly all dead within forty days, which is very much less than the time required for semi-ripe pods to reappear. The prunings must either be burnt or buried under an 8-inch layer of earth, and the whole area must be completely pruned, if re-infestation is to be prevented. As the beetles are good flyers it is necessary to have a distance of from 500 to 1,000 yards between pruned areas and unpruned ones.

VON TUBEUF (C.). **Nachträge zur Kenntnis des Fichtensamenöles und seiner Gewinnung.** [Additions to the Knowledge of Fir Seed Oil and its Production.]—*Naturwissenschftl. Zeitschr. f. For t- u. Landwirtschaft, Stuttgart,* xv, no. 7–9, July-September 1917, pp. 239–252.

By crushing fir seed it is possible to obtain about 20 per cent. of edible oil and 75 per cent. of oil-cake. The seeds in many fir-cones are infested by the larvae of *Plemeliella abietina,* Seitn. (fir seed gall midge), of which all the developmental stages were described by Seitner in 1908. Nitsche had previously reported the injury as affecting 15 per cent. of seed samples examined. The infested seeds are slightly sunken and discoloured, and they are flatter and more pointed than normal ones. According to Seitner development within the seed in the majority of cases takes three years. Pupation lasts eighteen days, and the adult midge escapes through an exit-hole bored before pupation. The eggs are deposited in the flowers, and the larvae bore into the ovulum, which attains the shape and size of a seed without a gall being formed. Seitner states that the larvae attain their full-growth in October when the seeds are ripe, so that five months only are required for this stage. As the seed is hollow and contains nothing but the larva, it is difficult to know what the latter feeds on during the two years between maturity and pupation.

ZIMMERMANN (H.). **Die Kohlwanze (*Eurydema oleraceum,* L.). Ein Beitrag zur der Kenntnis der Lebensweise.** [The Cabbage Bug, *E. oleraceum*: A Contribution to the Knowledge of its Habits.]—*Zeitschr. f. Pflanzenkrankheiten, Stuttgart,* xxvii, no. 4, 15th August 1917, pp. 193–199.

A brief description of *Eurydema oleraceum,* L., and notes on its distribution in Europe are followed by an account of an outbreak in Mecklenburg in 1915 and 1916, which was the most severe since 1893. White swedes were heavily infested and sometimes destroyed, hundreds of bugs being seen on each plant. Cabbages also were killed. In one case the destruction of the swedes was followed by migration to an adjacent potato field and the destruction of the plants there. An adjoining field of oats was also attacked, but without apparent damage. Coccinellids were noticed preying on the bugs in 1915. Wet weather checked the outbreak. On cloudy, cool days the insects may be shaken on to sheets of cardboard, and if the infestation is severe, a petroleum-soap spray will act to some extent as a repellent. Lysol, insect-powder, and trap-crops of mustard or radish have been recommended. Nicotine-soap proved useless in Mecklenburg, but covering the plants with earth gave good results.

MUTH (F.). **Die Knospenmilbe (*Eriophyes loewi,* Nal.) und der Heterosporiumpilz (*Heterosporium syringae,* Oud.), zwei Schädlinge des Flieders.** [The Bud Mite, *E. loewi,* Nal., and the Fungus, *Heterosporium syringae,* injuring the Elder.]—*Zeitschr. f. Pflanzenkrankheiten, Stuttgart,* xxvii, no. 4, 15th August 1917, p. 203. (Abstract from *Zeitschr. f. Wein-, Obst- u. Gartenbau,* 1914, pp. 22–27, 4 figs.)

Cutting back and burning the infested branches are the remedies advised for injury to elders by *Eriophyes loewi,* Nal.

Rörig (G.). **Schädlinge an Hülsenfrüchten.** [Pests of Leguminous Vegetables.]—*Zeitschr. f. Pflanzenkrankheiten, Stuttgart*, xxvii, no. 4, 15th August 1917, p. 205. (Abstract from *Flugblatt No. 57 der Ksl. Biol. Anstalt f. Land- u. Forstw.*, July 1915.)

Peas and beans may be freed from Bruchids by heating to 139° F., or the beetles may be sifted out if the seed, which has been stored in the cold, is first kept for a few days at 68°–71° F. in order to make them emerge. *Sitones lineatus* may be checked by collecting the weevils or by spraying with hellebore-soap with or without tobacco, or Urania green. Preventive measures against the moths, *Cydia (Grapholitha) nebritana* and *C. (G.) dorsana*, include selection of seed, careful preparation of the soil, sowing in drills and the avoidance of fresh stable-manure.

Muth (F.). **Die Milbensucht der Reben, verursacht durch die Milbe *Eriophyes vitis*, Nal., eine neue und gefährliche Krankheit unserer Weinberge, nebst einigen Bemerkungen über ähnliche Triebverunstaltungen.** [The Mite Disease of Vines, a new and dangerous Disease of our Vineyards due to *Eriophyes vitis*, Nal., and some Notes on similar Shoot-Deformations.]—*Zeitschr. f. Pflanzenkrankheiten, Stuttgart*, xxvii, no. 4, 15th August 1917, p. 205. (Abstract from *Hess. Landw. Zeitschr.*, 1916, pp. 442–443 & 458–459, 5 figs.)

This disease of vines, which is caused by *Eriophyes (Phyllocoptes) vitis*, Nal., was first observed in Hessen. For summer treatment cutting-back or spraying is recommended. Lime-sulphur (1 : 40), or nicotine soft soap (1 : 1 : 100), or Muth's solution (1 : 100) should be used. The stocks must be painted in addition with lime-sulphur (1 : 4) at the end of March after pruning.

Muth (F.). **Die Johannisbeeren-Knospengallmilbe (*Eriophyes ribis*, Nalepa) sowie einige andere Johannisbeerschädlinge.** [The Currant Bud Gall Mite, *E. ribis*, Nal., and some other Pests of Currants.]—*Zeitschr. f. Pflanzenkrankheiten, Stuttgart*, xxvii, no. 4, 15th August 1917, p. 206. (Abstract from *Hess. Obst- Wein-, Gemüse- u. Gartenbauzeitung*, 1915, pp. 17–23, 9 figs.

In Hessen *Eriophyes ribis*, Nal., causes serious injury to red and white currants and also, but to a less extent, to black currants. The injury is less a deformation than an excessive increase of buds. This paper also contains notes on damage to currants by *Aegeria (Sesia) tipuliformis*, *Aphis ribis*, and *A. grossulariae*.

Zweigelt (F.). **Beiträge zur Kenntnis des Saugphänomens der Blattläuse und der Reaktionen der Pflanzenzellen.** [Contributions to the Knowledge of Sucking by Aphids and of the Reactions of the Plant Cells.]—*Zeitschr. f. Pflanzenkrankheiten, Stuttgart*, xxvii, no. 4, 15th August 1917, p. 207. (Abstract from *Centralbl. f. Bakteriol.*, II, xlii, 1915, pp. 265–335, 7 figs., 2 plates.)

Details of the sucking process by Aphids are given. As with other Rhynchota the salivary secretions of Aphids must be able to convert starch into sugar with the help of a ferment resembling diastase.

KNECHTEL (W. R.). *Phlyctaenodes sticticalis*, **dem Tabak in Rumänien schädlich.** [*P. sticticalis* injuring Tobacco in Rumania.]—*Zeitschr. f. Pflanzenkrankheiten, Stuttgart*, xxvii, no. 4, 15th August 1917, p. 210. (Abstract from *Intern. Agrar-Techn. Rundschau*, 1916, p. 377.)

In 1915 the caterpillars of *Phlyctaenodes sticticalis* seriously damaged tobacco in Eastern Rumania, skeletonising the leaves.

UFFELN (K.). **Beobachtungen über die Eiablage von** *Cheimatobia brumata*, **L., und anderer Herbstspanner.** [Observations on the Oviposition of *C. brumata* and other Autumn Moths.]—*Zeitschr. f. Pflanzenkrankheiten, Stuttgart*, xxvii, no. 4, 15th August 1917, pp. 210–211. (Abstract from *Zeitschr. Wiss. Insekt. Biol.*, xii, 1916, pp. 121–124 & 169–175.)

In this reply to a paper by Schneider-Orelli the following statements are made: The female of *Cheimatobia brumata* lays 150 eggs on an average; in the forests, oviposition takes place preferably on those lower portions of the trunks that are covered with rough bark. [The German abstract suggests that the difference between forest and orchard conditions may account for the contradiction between this observation and Schneider-Orelli's statement respecting oviposition in the crowns of the trees.] In the forests large numbers of both sexes were seen on the ground and pairing took place there.

Various species of *Hybernia*, especially *H. defoliaria* and *H. aurantiaria*, also oviposit in the forest, preferably on the lower parts of the trunks. In Westphalia *C. brumata* usually appears late in October or early in November and flies until mid-December. It always pupates in the ground.

SEDLACZEK (W.). **Neuere Forschungen über Borkenkäfer.** [Recent Investigations on Bark-beetles.]—*Zeitschr. f. Pflanzenkrankheiten, Stuttgart*, xxvii, no. 4, 15th August 1917, pp. 212–213. (Abstract from *Zentralblatt f. das Gesamte Forstwesen*, xli, 1915, pp. 463–472.)

Sufficient labour is not always available to remove without delay trees that are dying as a result of bark-beetle infestation and the young beetles have time to emerge and migrate to other trees. To prevent this, suitable trap-trees should be arranged in an isolating belt around the infested area.

TREDL (R.). **Aus dem Leben des Birkensplintkäfers,** *Scolytus ratzeburgi*, **Jans.** (*Eccoptogaster destructor*, **Ratz.**) [Notes on the Life-History of the Birch Beetle, *Scolytus ratzeburgi*.]—*Zeitschr. f. Pflanzenkrankheiten, Stuttgart*, xxvii, no. 4, 15th August 1917, p. 213. (Abstract from *Entomolog. Blätter*, xi, 1915, pp. 97–102 & 146–154.)

Throughout Europe *Scolytus ratzeburgi*, Jans., has one annual generation and always hibernates in the larval stage. In N. Italy and other southern regions the flight period begins about 20th May, in Germany between 1st and 15th June. The flight lasts from three to five weeks according to the weather. The young beetles breed

immediately after flight and the females die in the brood-galleries after three to four months. At the entrance-hole and in the air-holes of the brood-galleries pairing takes place repeatedly during oviposition. Healthy birches also are attacked and killed after several successive attacks. Trap-trees standing alone must have a ring cut into them about twenty inches above the roots. This must be done in autumn or spring; the ring should be about five inches wide and deep enough to reach the sap-wood. Two years later the trap-tree must be felled in winter and removed. Woodpeckers and Ichneumonids help to check this pest.

TREDL (R.). **Biologisches von *Xyloterus signatus*, Fabr.** [Biological Notes on *X. signatus*, F.]—*Zeitschr. f. Pflanzenkrankheiten, Stuttgart*, xxvii, no. 4, 15th August 1917, p. 214. (Abstract from *Entomol. Blätter*, xi, 1915, pp. 165-169.)

Xyloterus signatus, F., has two generations a year. It is on the wing at an early date and is very particular as to the condition and dampness of the brood material. To ascertain the date at which trap-trees become attractive it is necessary to fell trees from spring to autumn and then see which of them is infested when flight takes place in the following spring. A dry, sunny situation may give different results to a damp, shady one. Very probably this Scolytid infests standing ringed trap-trees in the second or third year after ringing, as *X. domesticus* prefers to do in the case of ringed birches and alders.

SCHEIDTER (F.). **Ueber die Bekämpfung des grossen braunen Rüsselkäfers, *Hylobius abietis*.** [Notes on combating *Hylobius abietis*.] —*Zeitschr. f. Pflanzenkrankheiten, Stuttgart*, xxvii, no. 4, 15th August 1917, pp. 214-215. (Abstract from *Forstwissensch. Centralblatt*, xxxvii, 1915, pp. 113-125 & 270-284.)

This paper discusses the various measures hitherto adopted against *Hylobius abietis* and advises attention to the following points: Young plants should be protected for three successive years by suitable washes; if as a consequence adjacent older growth is not attacked, it is unnecessary to collect the beetles. Strong plants must be used for planting, though growing from seed is preferable. Blocks of wood, used as traps, and trenches must only be resorted to where the beetles abound in spite of the stumps being cleared, and the plants are not protected by washes. Where clear-cutting is practised, the next felling should follow the first young crop only after 8-10 years. Trap-trenches, artificial traps, barking, charcoal-burning, tarring and covering the stumps with earth are all measures that have little effect and are usually rather costly.

SCHULZE (P.). **Ueber *Diastrophus rubi*, Htg.** [Notes on *D. rubi*, Htg.] —*Zeitschr. f. Pflanzenkrankheiten, Stuttgart*, xxvii, no. 4, 15th August 1917, p. 216. (Abstract from *Deutsche Entomolog. Zeitschr.*) 1916, pp. 223-224.)

In Brandenburg the Cynipid, *Diastrophus rubi*, Htg., has been observed on raspberries, causing not only the ordinary cylindrical galls, but also twisted and forked ones.

TORNELLO (F. Cocuzza). **Parassiti dei Crisonfalo o "Bianca-Rossa" degli Agrumeti siciliani.** [The Parasites of the Sicilian Citrus Plantation Pest, *Chrysomphalus dictyospermi*.]—*L'Agricoltura Moderna, Milan,* xxiii, no. 13, 1st—15th July 1917, pp. 167–168.

In this list of the enemies of *Chrysomphalus dictyospermi* var. *pinnulifera*, Mask., brief notes are given in each case.

The insects dealt with are *Prospaltella* (*Aspidiotiphagus*) *lounsburyi*, from Madeira, which attacks the nymphs as well as the adults: *Prospaphelinus silvestrii*, discovered in Sicily, where it parasitises the nymphs; *Aphelinus chrysomphali*, somewhat similar to the preceding one, discovered in Spain and also occurring in Italy and Sicily; *Aphycus hesperidum* in Spain; *Aspidiotiphagus citrinus*, usually bred from the adults and found only in greenhouses; *Prospaltella fasciata*, another greenhouse parasite: *Signiphora merceti* from Spain; the Coccinellids, *Chilocorus bipustulatus*, *Rhizobius lophantae* and *R. ventralis*; and *Lycosa rapida*, found at Palermo, this spider being apparently more efficient than *C. bipustulatus*. The fungi infesting this scale are *Aschersonia*, *Cephalosporium*, *Nectria*, *Microcera* and *Fusarium*.

GRAVATT (G. F.) & MARSHALL (R. P.). **Arthropods and Gasteropods as Carriers of *Cronartium ribicola* in Greenhouses.**—*Phytopathology, Baltimore, Md,,* vii, no. 5, October 1917, pp. 368–373.

Studies with insects, wood-lice and snails feeding on various species of the genus *Ribes* attacked by the fungus, *Cronartium ribicola*, have shown that they have a decided preference for the infected leaves. The weevil, *Pantomorus fulleri*, was the principal insect concerned, but the red ant, *Pheidole anastassi*, and the wood-louse, *Armadillidium vulgare*, were active on leaves growing close to the ground. These, as well as the cockroach, *Blatta orientalis*, were found to be the bearers of numerous urediniospores and sporidia of *C. ribicola*, which under certain conditions may adhere to their bodies for at least a week. It was also found that after feeding on the different spore-stages of the blister-rust fungus, their excreta contained abundant urediniospores and in some cases sporidia and pieces of telial columns, and that although alimentation lessened the viability of both the uredinio- and telio-spores, animals are important agents in the dissemination and spread of this fungus.

WODSEDALEK (J. E.). **Five Years of Starvation of Larvae.**—*Science, Lancaster, Pa,* xlvi, no. 1189, 12th October 1917, pp. 366–367.

The last of a large number of specimens of *Trogoderma tarsale*, a beetle well known as a museum pest, survived without food of any kind for 1,884 days, and probably, under less disturbed conditions would have lived even longer. The starved larvae gradually decreased in size, as did also the series of cast larval skins, but if given a good supply of food, they again grew until they attained practically the maximum larval size.

SCAMMELL (H. B.). **Cranberry Girdler.**—*U.S. Dept Agric., Washington, D.C.*, Bull. no. 554, 21st September 1917, 20 pp., 7 pl.

Crambus hortuellus, Hübn. (cranberry girdler) is a Pyralid that has become increasingly injurious in recent years, large areas of cranberry vines having been entirely destroyed in New Jersey owing to the larval habit of feeding concealed in trash under the vines. This moth was originally described under the name *C. topiarius*, which was believed to represent the European *C. hortuellus* in the American fauna. It is widely distributed throughout Europe, the United States and Canada, where its food-plants include grasses, sheep sorrel and the sedge, *Scirpus americanus*.

All the injury to the cranberry vines is done during the larval stage from early June till mid-October, being worst in late summer when the caterpillars are nearly full-grown. They eat through the bark of the runners into the wood or completely girdle the bark, being themselves concealed in the trash beneath the vines. This habit distinguishes them from *Rhabdopterus picipes*, Oliv. (cranberry rootworm), which feeds below the surface of the ground on the small roots and root-hairs.

The eggs, which are laid in large numbers, are not attached to the plants, but are deposited on the trash beneath, where, owing to their minute size there is little possibility of finding them. The larvae, which emerge after nine or ten days, are rarely found in wet situations and are never found feeding in exposed positions owing to their aversion to light. Late in September or early in October they form cocoons within which they lie dormant until the following spring, when they pupate, the pupal stage lasting about twenty-one days. Larvae in cocoons are able to withstand the usual winter-flooding from December until April or May, or even until July, and pupae have been found alive after submergence for five or six days.

The most effective control measure is autumn flooding immediately after picking the crop, when this can be done before the end of September, at which date the larvae will not have spun their cocoons. If the berries cannot be removed in time to permit of this, the next best method is to retain the water over the vines until 20th July, thereby losing one crop of berries, but ensuring a clean bog and the possibility of a much heavier crop the following year. The application of a layer of sand from one to two inches deep, though expensive, is sometimes expedient on bogs having peat or mud bottoms, and prevents the emergence of a large proportion of the moths.

The usual methods of spraying, burning, and using repellents and trap-lights are of no avail owing to the habits of the larvae, but pruning, the removal of noxious weeds and grasses, and better cultural methods generally, very materially aid in the control of this pest.

JARVIS (E.). **Experiments in Poisoning Cane-Grubs.**—*Queensland Agric. Jl., Brisbane*, viii, Part 2, August 1917, pp. 81–82. [Received 2nd November 1917.]

Field experiments with poison-bait for cane-grubs on the lines of previous laboratory experiments [see this *Review*, ser. A., iv, p. 470] have shown that the application of Paris green in even heavier doses than previously suggested have no injurious effect, but rather the

reverse, on the growth of the crop. A test plot, on which cowpeas planted in trenches among sugar-cane had been dusted with copper arsenate at the rate of 24 lb. per acre and then covered over, gave quite as good results, both as regards the growth of the cane and the absence of grubs, as did neighbouring plots treated with carbon bisulphide.

Fumigating a Plant Stove.—*Gardeners' Chronicle, London*, lxii, no. 1610, 3rd November 1917, p. 184.

The best results are obtained when the houses are fumigated at dusk and opened on the following morning, being tightly closed meanwhile, and several fumigation bowls being used to ensure an even distribution. For green aphis one application of the following is sufficient: sodium cyanide ⅛ oz.; phosphoric acid ⅛ oz.; water ½ oz. for each 1,000 c. ft. This will not scorch any plant. For black or white aphis, thrips and scale-insects, one application of the following will suffice: sodium cyanide ¼ oz.; phosphoric acid ¼ oz.; water 1 oz. for each 1,000 c. ft. This will not scorch mature plants. For mealy bug (*Pseudococcus*) and red spider (*Tetranychus*) in a house of mixed plants, sodium cyanide 1 oz.; phosphoric acid 1 oz.; water 4 oz. for each 1,000 c. ft. should be used. A few of the young shoots may be affected by this, but only to a very slight extent.

Damage to Wheat-stacks by Mice.—*Jl. R. Soc. Arts, London*, lxv, no. 3389, 2nd November 1917, p. 830.

While the whole world is in urgent need of wheat, it is being wasted in Australia owing to the lack of transport necessitating its storage for an indefinite period, during which it is attacked by mice, causing a loss of 10 per cent., and by weevils, which in some places do even greater damage.

FLETCHER (T. B.). ***Icerya purchasi* in Ceylon: a Warning to India.**—*Agric. Jl. India, Agric. Research Institute, Pusa, Calcutta*, xii, pt. 4, October 1917, pp. 525–531, 1 pl.

The fluted scale (*Icerya purchasi*) has obtained a firm footing in Ceylon, where it first appeared on *Acacia* spp., spreading later to *Citrus*. Steps are being taken to introduce its natural enemy, the Coccinellid, *Novius cardinalis*, the action of which may be supplemented by spraying with red oil, lime-sulphur and kerosene emulsion sprays. The only countries at present free from this pest are India, South America and the West Indies.

OSBORN (H.). **Studies of Life-Histories of Froghoppers of Maine.**—*Maine Agric. Expt. Sta., Orono*, Bull. no. 254, September 1916, pp. 265–288, 13 figs. [Received 6th November 1917.]

A list of the Cercopids occurring in Maine comprises: *Aphrophora parallela*, Say, and *A. saratogensis*, Fitch, on pine; *A. quadrinotata*, Say; *Philaenus spumarius*, L.; *P. lineatus*, L.; *Lepyronia quadrangularis*, Say; *Philaronia bilineata*, Say; *Clastoptera obtusa*, Say, common on alder; *C. proteus*, Fitch, on dogwood; and *C. xanthocephala*, Germ.

The species dealt with in this bulletin include the meadow froghopper, *Philaenus spumarius*, which has a wide range of food-plants, comprising buttercup, yarrow, thistle, *Helianthus*, orange dock, daisy, clover, primrose, choke-cherry and plum, as well as several cultivated crops. The heads of the plants attacked wither and fail to produce seed. *P. lineatus* is a grass-feeding froghopper, preferring timothy-grass and redtop for its food-plants. The eggs of this species are evidently laid in the autumn, probably in the stems of their food-plants; the larvae hatch about mid-June, the frothy masses, which are a characteristic feature of these froghoppers, affording good protection to the nymphs during their development. From mid-July only adults are found, but oviposition is apparently delayed until about the end of August. Frequent rotation from grass to some other crop is advocated as a means of keeping the froghoppers in check, while ploughing should be done in spring or late autumn. As it is almost certain that eggs occur in the grass-stems during autumn, winter and early spring, burning the surface dead grass will destroy the eggs of these and many other species. The use of a hopperdozer immediately after the hay is gathered would trap recently-developed adults. Early mowing would probably reduce the numbers considerably, and, where the insects are abundant, the gain in later growth would probably compensate for the loss of quantity in the crop.

Lepyronia quadrangularis, Say (angulated froghopper), which greatly resembles the meadow species, is neither abundant nor of economic importance in Maine. Bush and tree froghoppers include *Aphrophora parallela*, Say, which is found abundantly on Scotch pine twigs; *Clastoptera obtusa*, Say, occurring on alder and a variety of plants and shrubs, including white birch and hazel; *C. proteus*, Fitch, found on a variety of plants, especially dogwood. *C. xanthocephala*, Germ., has been found in the nymphal stage on chrysanthemums, though the original food-plant may have been ragweed. *Philaronia bilineata*, Say, is rarely found in Maine, but occurs abundantly on the vegetation of the plains in Dakota and Montana.

HINDS (W. E.). **Carbon Disulphid as an Insecticide.**—*U. S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 799, June 1917, 21 pp. [Received 7th November 1917.]

Chemically pure carbon bisulphide is a clear, volatile liquid with a sweetish odour resembling that of ether or chloroform; it does not injure or stain fabrics or food materials. The commercial variety, however, which has a yellowish colour and unpleasant odour, due to contained sulphuretted hydrogen, should not be poured directly upon food-stuffs, although its vapour will not injure them.

As an insecticide it may be used against three classes of insects:—those that live underground on the roots of plants or that nest in the ground as do some Aphids, white grubs [*Lachnosterna*], mole-crickets, ants and others; species that attack stored products, such as grain insects, pea and bean weevils, various domestic pests and mill insects; and species that can not be controlled by the methods commonly employed for their near relatives, such as various wood-borers that can not be reached with poisons, but can be easily killed with vapours.

Owing to the effect of the vapour upon the heart's action, persons with weak hearts should not take an extended share in the application of this substance. The vapours may ignite without the presence of flame at a temperature above 297° F.

Carbon bisulphide is applicable only when the vapour can be quite closely confined for at least 30 minutes, and since a warm atmosphere can hold far more of the vapour than a cool one, it is not advisable to work at a lower temperature than 60° F., as the higher the temperature the more active and susceptible to the gas the insects become. Vaporisation may be hastened by applying the liquid to some absorbent material hung near the top of the room or bin so that the vapours may diffuse downwards, while in large warehouses the liquid may be applied by means of a spray pump. The best material with which to render rooms or bins air-tight is heavy wrapping paper of which the edges must overlap, care also being taken that the corners are well fitted. The fumigation of buildings is best undertaken on a Saturday so that they may remain closed till Monday, thus allowing of the complete diffusion of the vapours. Sacked cotton seed requires special treatment [see this *Review*, Ser. A, iii, p. 685]. Ants are most economically and effectively controlled by the use of trap-boxes filled with leaves, cotton seed and straw, to which carbon bisulphide is afterwards added; a single trap of this kind has been found to contain 1,000 fertile queens. Colonies of agricultural ants may be destroyed by pouring the liquid into the opening of the nest and covering the entrances with an inverted, galvanised iron tub; from one to three ounces of liquid should be used, and the tub left in position for five or six hours. Ants infesting the surface soil, white grubs and mole-crickets may be destroyed by making holes with a stick over the area to be treated, not more than 18 inches apart and several inches deep, pouring one ounce of bisulphide into each, closing them immediately and covering the ground with waterproof canvas, paper, or wet blankets to confine the gas. The best results against *Phylloxera* on vines are obtained by a similar treatment applied twice at an interval of from 6–10 days, preferably in spring. The holes should be 16 inches from the base of the vine, and 12–16 inches deep, fresh holes being made for the second application midway between the first, and ½ to ¾ oz. of the liquid being injected into each. Cabbage root-maggots [*Chortophila brassicae*] and their pupae may be destroyed by distributing a teaspoonful for small plants and a tablespoonful for large plants in one or two holes made not less than 4 inches from the base of the plant. Aphids on low-growing plants have been successfully controlled by evaporating the liquid under a tub which covers the plants, the liquid being used in the proportion of one teaspoonful per plant or per box of one cubic foot. Wood-borers may be killed by inserting one or two drops on a small wad of cotton and pushing it into the cavity as far as possible, afterwards sealing the aperture with wax. Clothes, woollen and felt goods and furs may be treated against clothes moths and other household insects by fumigation in a tight paper-lined trunk, while the use of the liquid in showcases, trays and boxes successfully wards off museum pests.

A factor that must be taken into account in fumigation is the varying resistance of different insects, for while the bumble-bee [*Bombus*] succumbs in a few seconds, *Bruchus* (*Pachymerus*)

chinensis, L. (cowpea weevil), *Calandra oryzae*, L. (rice weevil), and *Silvanus surinamensis*, L. (saw-toothed grain beetle), survive for 35, 60 and 120 minutes respectively. Experience has shown that there is practically no danger of injuring germination in seeds that have been well matured and dried before being treated with carbon bisulphide.

WALTON (W. R.). **How to detect Outbreaks of Insects and save the Grain Crops.**—*U.S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 835, June 1917, 24 pp., 14 figs. [Received 7th November 1917.]

This bulletin has been written for the information of growers of cereal crops and urges the necessity for vigilance and vigorous action at the beginning of insect outbreaks in order to avoid a great part of the annual losses due to grain pests. Methods of control are discussed for *Mayetiola* (*Phytophaga*) *destructor* (Hessian fly); *Blissus leucoptera* (chinch bug); *Cirphis unipuncta* (army worm); cutworms, such as *Lycophotia* (*Peridroma*) *margaritosa* (variegated cutworm); *Melanoplus* spp. (grasshoppers); *Lachnosterna* spp. (white grubs); *Sphenophorus maidis* (maize billbug) and *S. aequalis*; *Aphis maidiradicis* (corn root-aphis); and wireworms, such as *Corymbites noxius*. A daily survey of the fields during the active growing season is recommended, and any serious outbreak should at once be reported to one of the federal entomological field stations of which a list is given.

ROBINSON (E.). **Coccidae of the Philippine Islands.**—*Philippine Jl. Science, Manila*, xii, Sec. D, no. 1, January 1917, pp. 1–43, 6 plates. [Received 8th November 1917.]

This paper attempts to collect all obtainable information concerning the known species and available specimens of Philippine COCCIDAE. Though more than 70 species are recorded, it is believed that these represent only a portion of the abundant Coccid fauna of the Philippines. Most of the species here dealt with come from the Island of Luzon.

A useful index to the food-plants of the species recorded is appended.

MUIR (F.). **The Derbidae of the Philippine Islands.**—*Philippine Jl. Science, Manila*, xii, Sec. D, no. 2, March 1917, pp. 49–105, 1 plate, 4 figs. [Received 8th November 1917.]

The Philippine Islands are very rich in Derbids; the present paper records 98 species of 39 genera; of these 62 species are described as new and seven new genera are erected. A key to the subfamilies is given. Very little is known of the life-histories of these insects, the nymphs of which are found in rotten wood or under old bark. *Proutista moesta*, Westw., is frequently found on sugar-cane in Java, the Philippines and Formosa.

The author advocates the establishment of an entomological station in some such locality as Mount Maquiling, near Manila, where 55 species of Derbids were taken. There are many interesting problems presented by the insect fauna of the Philippines, the solution of which will mean the saving of valuable crops all over the tropics. Hitherto,

experimental zoology has been undertaken almost entirely in temperate climates, where biologists often have to wait a whole year for one generation, while in a tropical country it would be possible to study 10 or 12 in the same period.

CRAWFORD (D. L.). **Philippine and Asiatic Psyllidae.**—*Philippine Jl. Science, Manila,* xii, Sec. D, no. 3, May 1917, pp. 163–175, 1 plate. [Received 8th November 1917.]

Of the eighteen species of Psyllids described in this paper, thirteen are new, while two new genera are erected.

Euphalerus citri, Kuw., was collected in southern India on *Cordia cordata*; *Arytaina* (*Psyllopa*) *punctipennis*, Crawf., is a pest of indigo in the Orient and is probably identical with *Psylla isitis*, Buckt.: *Trioza fletcheri*, Crawf., has been collected in galls of *Trewia* sp.; and *T. jambolanae*, sp. n., was taken on *Eugenia jambolana*.

ANDERSON (T. J.). **Notes on Insects Injurious to Coffee.**—*Dept. Agric. British East Africa, Nairobi,* Agric. Bull. no. 2, 1917, pp. 20–43.

Swarms of *Schistocerca peregrina*, Ol. (migratory locust) sometimes settle on coffee bushes and break the branches by their weight, while the larvae of *Zonocerus variegatus*, L. and *Z. elegans*, Thb., destroy the leaves and flowers of coffee, being controlled by the use of poisoned bait if present in numbers. The first injurious attack by thrips was recorded in 1915 when a new species, *Diarthrothrips coffeae*, Williams, caused severe damage. A spray made by steeping 6 lb. tobacco leaf in 26 gals. water for 24 hours, straining and mixing with 2 lb. soft soap, was effective, but too expensive for use on a large scale. However an equally effective and cheaper spray composed of 5 lb. common blue soap to 40 gals. water applied twice within 3 or 4 days checked the attacks and almost wholly saved the crop. *Leucoptera* (*Cemiostoma*) *coffeella*, Staint. (coffee leaf-miner) has a wide distribution in the East African Protectorate, but up to the present has been regarded as a minor pest of coffee. Cutworms can be controlled in the usual ways, viz., by collecting, and by the use of collars and poisoned baits; a Limacodid caterpillar (*Parasa* sp.) is a minor pest that can be controlled by hand picking. The Longicorn, *Anthores leuconotus*, Pasc. (white coffee borer) is a pest of coffee in Zanzibar and elsewhere in Africa, but has only once, in 1912, been reported in the Protectorate on coffee. Owing to its attack, the stem may be partly or entirely ring-barked, cutting off the food-supply, and the stem and roots may be tunnelled and weakened. It is best combated by the injection of a drop or two of carbon bisulphide into the holes, which should then be plugged with clay. The borer, *Dirphya usambica*, Kolbe, and the leaf-eating beetles, *Idacantha magna*, Weise, *Systates irregularis*, Faust, and *S. cribripennis*, Fairm., have also been reported.

The most important of the Rhynchota attacking coffee is *Antestia lineaticollis*, Stål, generally treated as a variety of *A. variegata*, Thb. This bug in all stages pierces the leaves, young stems, berries and stalks of the berries, feeding on the juices, and experiments on its control are still being conducted; spraying in one district with a mixture of 5 lb. arsenate of lead paste and 4 lb. sugar to 50 gals. water gave good

results. The eggs are parasitised by a Chalcid, which in one plantation completely controlled the pest for more than a year. Two other bugs, *Agonoscelis puberula*, Stål, and *Bagrada picta*, L., have been reported on coffee, but the damage they do is slight.

The worst enemies of coffee, after *Antestia*, are scale-insects, which are naturally controlled by Chalcids, Coccinellids, and larvae of lace-wing flies. The best artificial control is spraying with kerosene emulsion made by dissolving ½ lb. Sunlight soap in 1 gal. boiling water, adding the oil to the hot mixture and churning till a perfect emulsion is made. The following spray is recommended for *Coccus viridis* and similar scales: resin 6 lb., washing soda 4½ lb., water 9 gals. The soda is dissolved in 3 gals. water and this is brought to the boil, the powdered resin being gradually added, and when the solution froths up, cold water is added to make 9 gals. This stock solution should be diluted to make 72 gals. spray, which, to be thoroughly effective, should be used on the day it is made.

BURGESS (A. F.) & COLLINS (C. W.). **The Genus *Calosoma*: including Studies of Seasonal Histories, Habits, and Economic Importance of American Species North of Mexico and of Several Introduced Species.**—*U.S. Dept. Agric., Washington, D.C.*, Bull. no. 417, 25th July 1917, 124 pp., 19 plates, 3 figs. [Received 10th November 1917.]

This bulletin deals with the recent study and investigation of the genus *Calosoma*, the authors' work up to 1915 having been already noticed [see this *Review*, ser. A, iii, pp. 715–717]. The eggs which are laid singly or in groups of two or three, hatch in from 3–15 days, depending upon the temperature, the season of the year and the species. *C. calidum*, F., and *C. reticulatum*, F., have a longer egg-stage than the other species, the eggs of *C. sycophanta* often hatching in 3 days during very hot weather. In New England the various species hatch from 20th May to 15th August, feed until mature upon Lepidopterous larvae and pupae, and after two moults pupate for a period of 10–15 days. The adult emerges during the latter half of July or in August, and *C. calidum* and *C. reticulatum* among other species reach the surface and feed, while *C. sycophanta*, *C. frigidum*, Kirby, and other species remain in the pupal cavity until the following spring before emerging and taking food. Under field conditions the adults live for three or four years, or more, depending on their reproduction in various years. All the species thus far reared have only one generation annually. The adults and larvae of all the species under laboratory conditions readily feed on Lepidopterous larvae and pupae, and sparingly on the immature stages of Coleoptera and Diptera. The larvae of *C. sycophanta* are abundant at the time when the caterpillars of *Lymantria* (*Porthetria*) *dispar* are entering the pupal stage, and, as much food is required for their development, they exert a particularly effective control on this pest. Both the adults and larvae of *C. calidum*, F., which feed on and near the ground, destroy annually large numbers of cutworms during the spring and early summer, the fact of the species being more or less nocturnal in its habits increasing its efficiency.

The increase of any species of *Calosoma* is limited by the possible food supply, by the adaptation of its habits to the feeding and pupation habits of its Lepidopterous host, by cannibalism among the larvae of different species in cases where the food supply is greatly restricted, and by the climbing habits of some species, which thereby assume a greater economic importance.

The natural enemies of this genus include toads, skunks and various species of insectivorous birds, as well as predaceous and parasitic insects such as a bug, *Podisus* sp., and a Tachinid fly, *Pseudatractocera calosomae*, Coq.

In the tables which are given for determining the adults and larvae of this genus, the species included are *C. sycophanta*, L., *C. inquisitor*, L., *C. reticulatum*, F., and *C. auropunctatum*, Payk., imported from Europe, and *C. chinense*, Kirby, and *C. maximowiczi*, Mor., from Japan.

The bulletin concludes with detailed descriptions of 38 species, a bibliography of each being appended.

COAD (B. R.) & McGEHEE (T. F.). **Collection of Weevils and Infested Squares as a Means of Control of the Cotton Boll Weevil in the Mississippi Delta.**—*U. S. Dept. Agric., Washington, D.C.*, Bull. no. 564, 4th October 1917, 51 pp., 2 plates.

The experiments on cotton boll-weevil control made in 1915 and already noticed [see this *Review*, Ser. A, iv, p. 418] were continued the following year, with the special object of ascertaining the value of various methods of collecting boll weevils [*Anthonomus grandis*] and infested cotton bolls as a means of control. It was found that picking operations were a complete failure in exerting any appreciable effect on the infestation, the maximum amount of benefit being derived during a year of light infestation, as in average years there is a great excess of weevils for producing the maximum injury to the crop, and a considerable number of these can be removed without appreciably increasing the crop secured. This is especially discouraging in view of the fact that in a year of heavy infestation the control measure is most needed.

The use of the bag-and-hoop as a means of collecting the weevils, proved to have a most injurious effect on the plants, the loss of the terminal buds due to the shaking, and the constant bending resulting in a dwarfed bushy growth. A mechanical collector driven between the rows while the plants were violently agitated was equally unsatisfactory, badly breaking the stems when driven close enough to catch the weevils. As a mechanical picker seems to be the only solution of the labour problem involved in the collection of weevils and squares, this failure to give satisfactory results is very discouraging.

BACK (E. A.) & CROSSMAN (S. S.). **Miscible Oil** ***versus*** **Fish Oil Soap Sprays for the Control of Florida Aleurodids.**—*Jl. Econ. Entom., Concord, N.H.*, x, no. 5, October 1917, pp. 453–458.

Spraying experiments that have been carried on more or less continuously during recent years against Aleurodids on citrus in Florida have proved beyond question the superiority of particular miscible oil sprays and standard brands of fish-oil soap. Certain home-made

miscible oil sprays are recommended as being cheap and effective, and the present paper includes data secured during experiments in 1910 which form a basis for comparison between these sprays and those made of fish-oil soap.

Table I records the influence of summer showers upon the effectiveness of miscible oil and soap sprays. Experiments showed that miscible oil sprays are scarcely affected by showers, except when these fall immediately after application. Showers falling 30 minutes after the oil spray had been applied had little effect upon the percentage of larvae and pupae killed, while they had a very evident effect upon the numbers killed by the soap spray. Besides being more resistant to showers, the miscible oil sprays are operative for a longer period after application, even when no showers fall.

Table II records the re-infestation of foliage two or three weeks after the use of miscible oil and soap sprays. Throughout the summer months adults of both *Dialeurodes citri* and *D. citrifolii* are more or less abundant and are depositing eggs. At the time of summer spraying there are but few leaves on infested trees that do not bear a certain number of unhatched eggs of *D. citri*. It matters little, therefore, how effective an insecticide may be in killing larvae and pupae at the time the spray is applied, if it does not either kill the eggs or operate long enough to kill larvae that subsequently hatch from them. On trees sprayed with fish-oil soap, 95% of the larvae and pupae were killed, but a sufficiently large number of larvae hatched after the spray was applied to cause blackening of the foliage within a short time. In a similar plantation sprayed with miscible oil, not only were an equally large number of insects killed, but the trees remained free from infestation for a much longer time. Miscible oil used in the strength $1\frac{3}{4}$ per cent. oil was found to have equal killing power with 5 and 8 lb. fish-oil soap to 50 U.S. gals. water, while its effects outlasted a second and third application of the latter spray. When the growers of citrus trees realise that it is more profitable to spray when the numbers of whiteflies on the leaves is still small, the advantage of miscible oil spray over fish-oil soap will be even more apparent in postponing future blackening of the trees and fruit by sooty mould.

Safro (V. I.). **How to test for the Presence of Nicotine on Sprayed Plants.**—*Jl. Econ. Entom., Concord, N.H.*, x, no. 5, October 1917, pp. 459-461.

Experiments conducted in the autumn of 1916 confirmed the conclusion, which had already been conjectured, that nicotine may be present, and continue to have some action, for a considerable time after the spray has dried and apparently disappeared from the plant. The explanation seems to be that in the evaporation of dilute solutions under ordinary temperatures the water evaporates much more rapidly than the nicotine, resulting in a continually increasing concentration of the nicotine film on the sprayed parts of the plant, until finally a very highly concentrated though invisible film of nicotine remains. The actual amount left may be so small as to defy any attempt to determine it quantitatively and yet may show quite distinctly in a qualitative test. The action of this film as an insecticide is as yet undetermined; it is generally thought that it may act as a

stomach poison when eaten by chewing insects, or its odour may have some fumigating effect. Possibly the film acts as a direct contact insecticide, on larvae as well as on other stages, and being so highly concentrated, may prove fatal by mere contact.

MERRILL (D. E.). **A Clerid Larva Predaceous on Codling Moth Larvae.**—*Jl. Econ. Entom., Concord, N.H.*, x, no. 5, October 1917, pp. 461–464.

A previous note has been published on this subject [see this *Review*, Ser. A, ii, p. 386]. The unidentified species of Clerid referred to in that paper was subsequently kept under observation for over 22 months, during which time the larva moulted several times and ate 12 codling moth larvae out of a number supplied to it. At the end of this period the larva was very sluggish and was evidently preparing for pupation when it was killed and partly devoured by another larva of its own species, though larvae of *Cydia pomonella* were present. The species was identified as *Cymatodera aethiops*, Wolcott, which is said to be usually found on partly dead branches and shrubs, or hiding under loose bark. Very little is known of the behaviour of the adults in the natural state, and though larvae have been collected from codling moth bands on apple trees, and a pupa has been found under a band in a codling-moth cocoon, there is some doubt as to the economic importance of *C. aethiops* in relation to the control of this moth. Clerids are mainly carnivorous, but under natural conditions this species probably does not confine its attacks to the larvae of the codling moth. Where bands are kept on apple trees in winter, the food-supply is constant and the Clerids are protected, but even under these conditions they do not appear ever to be sufficiently numerous to dispose of the codling-moth larvae present on the trunks on which they are found. Considering their long developmental period, their small numbers and their variable diet, the efficacy of this species in the control of *Cydia pomonella* is reduced to a minimum.

PATCH (E. M.). **An Infestation of Potatoes by a Midge (Diptera, Chironomidae).**—*Jl. Econ. Entom., Concord, N.H.*, x, no. 5, October 1917, pp. 472–473, 1 plate.

In October 1913 an investigation was made into potatoes on three farms in Maine, which were infested with the larvae of a Chironomid tunnelling down into the healthy tissue of the tubers. The larvae were abundant in the trails, 15 or 20 in some cases being found together. No pupae were obtained from these larvae and by the middle of November all were dead. A specific determination was not possible under the circumstances, but the larvae were thought to be probably those of *Camptocladius* sp. No further attack has come to the knowledge of the author and it is hoped that the infestation was encouraged by some local condition which may not recur.

DUNN (L. H.). **The Cocoanut-tree Caterpillar (*Brassolis isthmia*) of Panama.**—*Jl. Econ. Entom., Concord, N.H.*, x, no. 5, October 1917, pp. 473–488, 2 plates.

Coconut culture on the Isthmus of Panama is an important and extensive industry, the value of which is likely to increase in the future.

The most destructive insect enemy of *Cocos nucifera* in Panama is the butterfly, *Brassolis isthmia*, which is native to the country.

Injury is confined to the larval stage, when the caterpillars begin to feed midway down the leaflets, frequently eating through the midrib and amputating the distal end, which falls to the ground. The caterpillars fasten the ends of the leaflets together from opposite sides of the main stalk so that they extend downwards, thus forming a nest in the shape of a funnel-like bag which is lined with silk and frequently divided into several compartments. The leaflets are probably brought down into position by the weight of the large numbers present in the nests, ranging from 50 to 2,000. Injury has been known to extend to other trees, caterpillars having been observed in numbers feeding upon the royal palm, though no nests have been found in these trees.

There are two broods of *B. isthmia* in a year. The first eggs are deposited in May and June, and those of the second generation from late October until early December. The different stages largely overlap and all forms may be found at one time. Eggs are frequently laid on the lower sides of leaves or on the trunk of the coconut, but many are also found on buildings or in any sheltered place, protection from the weather evidently being the chief purpose in the choice of a site. They are laid in masses ranging from 150 to 300, and are covered with a clear mucilaginous substance and hatch in 25 to 30 days. Nest-building is accomplished before the larvae reach maturity. These nests, when well constructed, are generally waterproof and afford good protection from enemies, and as the larvae are nocturnal in habit and seldom appear by day, they are very difficult to deal with and may destroy all the foliage on a tree in a few nights. During April, and again in September, the mature larvae of the two generations leave the trees and seek places in which to pupate. The pupal stage lasts from 14 to 17 days.

Methods of control such as spraying are unsatisfactory owing to the habits of the caterpillars, while the application of stomach poisons would be expensive and almost useless under such conditions. The only effectual remedy is the removal of nests with the caterpillars inside; these can then be crushed in heavy mortars or thrown on a hot fire, or may be killed by dipping in a strong contact insecticide. This is a troublesome method, the nests being high in the trees and requiring long extension ladders to reach them, but if done at the proper time, once during the season should be sufficient. They should be removed early and before the caterpillars have become fully grown, otherwise these will have left the nest to pupate before it is removed. Banding the trees with a thick coat of tar or other sticky substance at some distance from the ground will prevent young caterpillars from reaching the leaves, if carried out at the time when the young larvae are hatching.

Natural enemies of *B. isthmia* include birds, toads, lizards and ants. Parasitic insects destroy many pupae, but experiment has proved that it is the pupal stage only that is attacked, after the caterpillars have done the damage. These parasites include Chalcids, Sarcophagids and Tachinids, but unfortunately they are not peculiar to *B. isthmia*, merely attacking it as an accidental or occasional host. More important than any parasitic enemy is a fungus that attacks the mature

caterpillars and the pupae. This causes a high mortality every season, especially during a period of heavy rainfall; probably for this reason the autumn brood suffers more heavily than the earlier one.

VINAL (S. C.). **Notes on the Life-history of *Marmara elotella*, Busck, a Lepidopterous Sap Feeder in Apple Twigs.**—*Jl. Econ. Entom., Concord, N.H.*, x, no. 5, October 1917, pp. 488–496, 1 fig.

Investigation into serpentine mines in the bark of apple twigs in Massachusetts has proved them to be the work of sap-feeding Tineid larvae of the genus *Marmara*. Adult moths, which have never previously been reared from apple, were bred in the laboratory and identified as *Marmara elotella*, Busck. Miners almost invariably confine their feeding to foliage, but a few larvae of the genus *Marmara* mine just under the epidermal layer of bark. *Marmara salictella* has been observed mining the bark of the yellow willow tree; *M.* (*Gracilaria*) *fulgidella* mines in twigs of white oak and chestnut. Leaf-mining species include *M.* (*Phyllocnistis*) *smilacisella*, on smilax; *M. guilandinella*, on *Guilandia bonducella*; *M. arbutiella*, on arbutus trees; and *M. opuntiella*, on *Opuntia* sp. An unidentified species of *Marmara* mines in orange peel in Southern California.

M. elotella is apparently widely distributed within the State, apple twigs in many places showing the long, narrow and tortuous mines that characterise all species of *Marmara*. The larvae separate the cuticle of the bark from the green bark by cutting through a row of cells. From the beginning of each mine the tunnel gradually widens as it nears completion, the average length being between 2 and 3 feet. Similar mines due to different species are found on poplar, ash and pine.

The eggs of *M. elotella* are deposited singly on the smooth bark of apple twigs, generally on the two-year-old wood, to which they are attached by a mucilaginous secretion. After about ten days the young larvae hatch, and, without exposing themselves, immediately enter the twig and begin to construct mines which extend partly around the twig before running lengthwise. After moulting twice, they hibernate in the mines, being protected from climatic changes by the dead bark covering the tunnel. In the spring they are again active, moulting again about mid-May and becoming mature during June; they then become quiescent on one side of the mine. Hitherto all species of this genus have been described as emerging from their mines and spinning cocoons, surrounded with frothy globules, in protected crevices. *M. elotella* differs from these species in having a pseudo-pupal stage during which it becomes more cylindrical in shape and finally breaks away the epidermal covering of the tunnel. The spinning larva then emerges and spins a few threads, forming with the cuticle a longitudinal fold under which the white silken cocoon is spun. Upon completion of the cocoon the larva transforms to the pupa, in late June or early July. The moths emerge towards the end of July, the species thus requiring a full year for its life-cycle.

An unidentified Chalcid parasite is an efficient control of these miners, many of its pupae being found within the cocoons of *M. elotella*.

EWING (H. E.). **New Species of Economic Mites.**—*Jl. Econ. Entom., Concord, N.H.*, x, no. 5, October 1917, pp. 497–501.

The species of mites described in this paper as occurring in the United States, all of which are of economic importance, are as follows: *Tetranychus uniunguis*, sp. n., on arbor vitae (*Thuja occidentalis*); *T. multidigituli*, sp. n., on the bark of honey locust (*Gleditsia triacanthos*); *Schizotetranychus latitarsus*, sp. n., on bamboo; *Caligonus mali*, sp. n., injuring leaves and branches of apple; *Hypoaspis armatus*. sp. n., on lemon leaves; *Tarsonemus pallidus*, Banks, on cyclamen: *Monieziella bipunctata*, sp. n., on the buds of filbert.

FELT (E. P.). **Apple and Thorn Skeletonizer (*Hemerophila pariana*, Clerck.)**—*Jl. Econ. Entom., Concord, N.H.*, x, no. 5, October 1917. p. 502.

Hemerophila pariana is widely distributed in New York State, the caterpillars skeletonising the upper surface of the leaves of apple and hawthorn, drawing in a strip on each side and spinning a light web near the centre of the leaf. The work of this moth differs from that of the fall webworm [*Hyphantria cunea*] by the absence of the enveloping web enclosing one or more leaves. The larvae are found on apple and hawthorn in May, June and August, while caterpillars of various sizes are found on the leaves at the end of September. The caterpillars are easily destroyed by poison and, since they feed upon the upper surface of the leaf, it should be impossible for the insect to become abundant in well-sprayed orchards.

BAKER (A. C.). **The Reddish-brown Plum Aphis in New York State.**—*Jl. Econ. Entom., Concord, N.H.*, x, no. 5, October 1917, pp. 503–504.

These notes are supplementary to a recent paper by Davidson [see this *Review*, Ser. A, v, p. 408]. It is pointed out that a species of *Rhopalosiphum* was recorded on a plum tree near Albany, N.Y., as early as 1897. Examination of these specimens, which have been preserved, proves them to be spring migrants of *R. nymphaeae*. This is probably the earliest record of the plum-feeding habit of this species in America. Specimens have recently been received from Thomasville. Georgia.

McGREGOR (E. A.). **Scientific Note on Beetles Causing Damage to Cotton in Yuma Valley, Arizona.**—*Jl. Econ. Entom., Concord, N.H.*. x, no. 5, October 1917, p. 504.

Attempts to secure a crop of cotton on 500 acres of ground in Arizona twice ended in complete destruction of the seedlings, owing to the depredations of vast numbers of a beetle, *Myochrous longulus*, Lec. Search in the soil revealed great numbers of these insects feeding on the under-ground portion of the cotton seedlings and also on the subterranean stems of trailing-mallow (*Baccharis* sp.) and especially on arrowweed (*Pluchea sericea*), with which the land had formerly been planted. This plant was infested to such an extent that it seems probable that it is the native host of this pest and that, following its eradication, the beetles transferred their attentions to the young cotton plants.

HOWARD (L. O.). **A Second Importation of the European Egg-Parasite of the Elm Leaf-Beetle.**—*Jl. Econ. Entom., Concord, N.H.*, x, no. 5, October 1917, pp. 504–505.

In 1908 an attempt was made to colonise *Tetrastichus xanthomelaenae,* the European egg-parasite of *Galerucella luteola* (elm leaf-beetle) in the United States. The species has not however been recovered in the States since that time. In June of the present year, a number of parasitised eggs of *G. luteola* were imported from Montpellier, and, although eggs of the elm leaf-beetle were at the time difficult to find, the parasites were finally liberated, some in Philadelphia and some at Ithaca. Another importation is promised in 1918, and the author invites notification of any wish to establish colonies next June in regions where the elm leaf-beetle is abundant.

CHAGNON (G.). **A Preliminary List of the Insects of the Province of Quebec. Part iii—Coleoptera.**—*Supplement to Rept. Quebec Soc. for the Protection of Plants, Montreal,* 1917, pp. 161–277. [Received 13th November, 1917.]

This list records 1810 species of beetles found in the Province of Quebec.

TREHERNE (R. C.). **The Natural Immunity or Resistance of Plants to Insect Attack.**—*Agric. Gaz. Canada, Ottawa,* iv, no. 10, October 1917, pp. 855–859.

Generally speaking, native plants are less susceptible than cultivated, introduced ones to the attacks of native insects. Variations occur in all plants that may constitute a certain degree of resistance to insect attack, though it is impossible to deduce any special explanation for these. Thus *Kaliosysphinga ulmi* (European elm saw-fly) attacks English and Scotch elms in preference to the American elms, while *Gossyparia spuria* (European elm scale) attacks the American elms more seriously than the imported English elms; *Euzophera semifuneralis* (American plum borer) prefers the European or imported varieties of plum, though it also occurs in the native kinds; *Rhagoletis pomonella* (apple maggot) infests the sweet and sub-acid summer varieties in preference to the acid autumn and winter sorts; *Bryobia pratensis* (brown mite) is seldom found on quince or apricot, though it attacks a great variety of trees including almonds and peaches.

Normal, hardy, vigorous growth is a necessary factor in developing natural powers of resistance, highly cultivated and debilitated plants being very susceptible to insect injury. The type of soil bears both directly and indirectly on the subject of insect attack, as in the case of *Conotrachelus nenuphar* (plum curculio), *Macrodactylus subspinosus* (rose chafer), *Adoxus obscurus* and *Fidia viticida* (grape root worm) which prefer light, sandy and gravelly soil in which they thrive, while crops grown on it do not and are therefore less resistant to their attacks.

The connection between the stages of maturity of a plant and the life-history of an insect pest determines whether crops of certain varieties are injured more than others. Thus *Contarinia* (*Diplosis*) *tritici* (wheat midge), which has a minute and delicate ovipositor,

requires the wheat plant to be in a certain stage of flowering before eggs can be deposited between the glumes. The damage due to *Taeniothrips inconsequens* (pear thrips) depends on the degree of development of the fruit when the adults appear in the spring, early varieties suffering more severely, the same being true of *Contarinia johnsoni* (grape blossom midge), which damages the earlier varieties of grape.

The attacks of *Cydia pomonella* (codling moth) are influenced by climate and locality, the cold backward spring of the Pacific coast delaying the appearance of the adult and reducing the damage due to it. *Bryobia pratensis* (apple red-spider) is favoured in its development by drought, and those trees are affected most which suffer from lack of moisture. Crops growing near woods and waste lands often suffer severely from specific troubles due to their environment, insects that may be mentioned in this connection being *Syneta albida*, *Cercopeus artemiseae*, *Mimetus setulosus*, various Elaterid beetles, *Otiorrhynchus ovatus* (strawberry root weevil) and many others.

The dislike for certain plants exhibited by some species is well known, such as that of *Malacosoma erosa* (western forest tent caterpillar) for the pear tree, of the cutworm, *Lycophotia margaritosa* (*Peridroma saucia*) for black currants, lettuce, etc., and of *Phytometra californica* (alfalfa looper) for the maize plant; in the same way some species of apple are immune to the attacks of *Eriosoma lanigerum* (woolly aphis), and some pear stocks to those of *Aspidiotus perniciosus* (San José scale).

MACKIE (D. B.). **A Summary of the Work of the Pest Control Section for the Year 1916.**—*Philippine Agric. Review, Manila*, 1917, x, no. 2, pp. 128–145.

The locust situation in the Philippines is more encouraging than at any time since the establishment of the locust office, owing to the amendment of the Locust Act, which provides that all persons between the ages of 16 and 60 inclusive, shall, in time of locust outbreak, render two days a week gratuitous service to the Government in the extermination of locusts. In cases where personal reasons render this obligation inconvenient, it can be redeemed by a payment which thus automatically provides a fund to defray the expenses of the campaign. The extermination of locusts is considered impossible, but they can be kept below the point of injurious abundance if municipal officials conduct their campaigns vigorously, and, with inspectors available for use in any province, it is often possible to check outbreaks that would otherwise become widespread and serious.

Investigations are in progress to determine whether the presence of certain insect pests of coconuts determines the prevalence of budrot, and it has been found that *Rhynchophorus pascha*, Boh., is a persistent feeder on the decayed part of diseased trees. The chief pests of coconut palms are the rhinoceros beetle [*Oryctes*] and the weevils *Rhynchophorus ferrugineus*, Oliv., and *R. pascha*, the latter being a particularly active and persistent pest, a single larva having been known to gnaw its way from the base to the crown of a tree 14 feet in height. An outbreak of *Aleurodicus destructor*, Quaint. (whitefly) was checked by the simple but drastic treatment of cutting off and burning the infested fronds. For several seasons a Limacodid, *Thosea cinereomarginata*,

Banks, has defoliated the palms in Mindanao, while in Luzon it is innocuous, being held in check by its natural enemies. Other minor or local pests of the coconut are the butterflies *Padraona chrysozona*, Plötz, and *Amathusia phidippus*, and a leaf-miner beetle, *Promecotheca cummingi*, Baly.

The tobacco pest, *Lasioderma serricorne*, F., has always occasioned great loss to manufacturers owing to their prejudice against treating their products chemically. However an apparatus has now been devised by means of which all beetles in tobacco products can be killed, whether in the egg, larval, pupal or adult stage. The process consists in heating the tobacco to a temperature higher than the vapour tension point of water at a pressure of 28 inches, after which air is pumped out till a 28-inch vacuum is registered by the vacuometer. The result is that the water content of all bodies is thereby changed to the gaseous form, thus causing the death of all insects.

A sugar-cane borer, probably *Diatraea venosata* (*striatalis*), has been noted in two provinces, but is evidently controlled locally by some native parasites, as it has never reached the point of injurious abundance. *Proutista* (*Phenice*) *moesta*, Westw., has been very abundant, causing extensive damage by sucking the juice from the leaves, while two species of leaf-hoppers have been held in check by natural enemies.

The death of a large number of abaca plants [*Musa textile*] was found to be due to a weevil, *Cosmopolites sordidus*, Germ., a common local banana pest, the only means of controlling which lies in the destruction of the affected plants.

The rice pest, *Schoenobius incertellus*, Walk. (*punctellus*, Zell.) has never been present in numbers sufficient to cause damage in districts where the entire plant is destroyed after harvesting. Hand-picking the infested stems as soon as the head turns white destroys the larvae and forms an effective control. The only remedy against the rice-bug, *Leptocorisa acuta*, Thunb., seems to lie in delaying the planting of quick-maturing varieties so that the entire crop will ripen at the same time; otherwise the earlier crops are attacked and rendered valueless.

During the year the following insect pests have been intercepted: *Hemileia vastatrix* and Coccids on plants and cuttings from Java; Curculionid larvae in seeds from Costa Rica; Curculionid and Dipterous larvae and mites in seeds from British India: Coccids on plants from Japan; Pyralid larvae and moths from Mauritius and Straits Settlements; Bruchids and Curculionids in seeds from Hawaii; Aphids and Coccids from Japan.

A phase of pest control work that has yielded good results consists of lectures on *Prodenia litura*, F. (tobacco worm), *Idiocerus clypealis* (a leaf-hopper attacking the mango blossom), and a Tortricid web-worm attacking the young leaves: these are delivered in the native dialect of the town in which the inspectors are operating.

FERNALD (H. T.). **Department of Entomology.**—*Twenty-ninth Annual Report Massachusetts Agric. Expt. Sta., Boston*, January 1917. 78a–79a. [Received 14th November 1917.]

During 1915 the ravages of *Otiorrhynchus ovatus*, L. (strawberry crown girdler) were recorded, but the methods of treatment adopted

successfully checked further injury in the following year. In the course of 1916 frequent inquiries were received about bean weevils [*Bruchus*], white pine weevil [*Pissodes strobi*], gipsy moth [*Lymantria dispar*], red-humped apple-tree caterpillar [*Schizura concinna*], carrot rust fly [*Psila rosae*, F.], grape plume moth [*Oxyptilus periscelidactylus*], pear midge [*Contarinia pyrivora*] and tarnished plant bug [*Lygus pratensis*]. Aquatic Dipterous larvae collected in a milk can were also received during the year.

Bowell (E. W.). **Larva of a Dipterous Fly feeding on *Helicella itala*.**—*Proc. Malacological Soc., London,* xii, pt. 6, November 1917, p. 308.

Some Dipterous larvae recently found destroying a mollusc, *Helicella itala*, in Surrey have been bred out and found to be those of *Sarcophaga nigriventris*, Meade.

Hobley (C. W.). **Life-History of the Coconut Beetle.**—*Jl. E. Africa & Uganda Nat. Hist. Soc., Nairobi,* vi, no. 11, March 1917, pp. 189–190. [Received 15th November 1917.]

Oryctes monoceros is a great pest in the coconut plantations on the coast in East Africa. The adult beetle bores into the trunk to oviposit, and the larvae hatch out and feed on the interior of the stem, retarding its growth and often killing young plants. The duration of the egg-stage is 12 days, that of the larval stage 3 months, of the pupal stage 40 days, while the length of adult life is unknown.

Clausen (C. P.). **Citrus Culture in Japan, China and Formosa.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento,* vi, no. 10, October 1917, pp. 379–383, 3 figs.

In Japan much injury is done to citrus trees by whiteflies and various other insect enemies. The control of scale-insects is usually attempted by fumigation, but this is proving a very expensive method. The process is generally carried on in the daytime, oiled paper tents being used instead of canvas; these are cheaper, but less durable, and require constant patching. In China the insect pests of citrus are not nearly so numerous or destructive as in Japan and it is very seldom that infestation is serious. A large Cerambycid borer, however, has been known to cause extensive injury, the larvae boring into the trunk and larger branches and frequently girdling the tree. The only remedy is to cut out the larvae with a knife.

Vickery (R. K.). **The Selection of Petroleum Insecticides.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento,* vi, no. 10, October 1917, pp. 384–387.

This paper discusses the various forms of petroleum insecticides and the importance of selection with a view to possible injury to plants. The concentration of oil in water must be the minimum that will kill the insect, so that injury to the plant may be as slight as possible. The question of application of the oil is simply mechanical where

plants are not concerned, as in the control of mosquito larvae, household pests, etc., but where plants are involved, dilution with water into the form of an emulsion is necessary. The simplest form of an emulsion is produced by the mechanical agitation of oil and water until a momentary emulsion is formed; this must be applied to the plant before it breaks up again into its constituents. Most of the emulsions used for spraying are rendered more or less permanent in character by the addition of a third substance, known as the emulsifier, which must be colloidally soluble in the dispersing liquid. Soap, which is colloidally soluble in water, is the usual emulsifier in petroleum insecticides, though other substances, such as iron hydroxide, soluble silica, zinc sulphide and gelatine all give excellent emulsions. The function of the emulsifier is to form a layer or pellicle around the oil drops to keep them from coalescing, though how this is effected is still a matter of conjecture. The author has found that heat is absorbed in the formation of an emulsion which would indicate a molecular rearrangement, and this is further demonstrated by the fact that in a true emulsion, where there is a maximum of oil emulsified in a minimum of water, the viscosity of the resulting emulsion is always greater than that of its component liquids.

In making a spray emulsion, the emulsifier is added to the water and the oil then added gradually. If the emulsion is to be very much diluted, the oil can be put in all at once. It is necessary to follow this general scheme in order that the emulsion shall contain the oil in the form of drops. For spraying purposes, an emulsion approaches perfection as the drops become smaller and more uniform in size, the emulsion being much more stable with small even drops, while the application is more uniform, thus increasing the insecticidal power of the spray. There is also less fear of scorching the plant when no drops of free oil can gather. Up to a certain point the addition of more emulsifier will decrease the size of the drops. The minimum size of the drops seems to be a function of the oil. The method of determining the size of the drops, by means of a compound microscope equipped with an oil immersion lens and an eye-piece micrometer, is described. The so-called miscible oils are a commercial preparation in which the emulsifier is held in the oil either by suspension or by colloidal solution. These miscible oils when mixed with water make excellent emulsions, but it is difficult to make a uniform product and the price at which the oil is sold makes it uneconomical for orchard use.

DAVIDSON (W. M.). **The Pear Woolly Aphis.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, vi, no. 10, October 1917, pp. 390–396, 2 figs.

The biology of *Eriosoma pyricola*, Baker and Davidson (pear woolly aphis), which until recently has been confused with *E. lanigerum*, Hausm. (woolly apple aphis), has previously been dealt with [see this *Review*, Ser. A, iv, p. 369]. The root Aphids suffer very little from natural enemies, a single *Scymnus* larva being the only predator observed by the author, while no parasitic enemies have been encountered. Against this Aphid, fumigation of the trees in air-tight boxes is recommended, 1 oz. sodium or potassium cyanide being used to each 100 cubic ft. of space, the process lasting 45 minutes. For

orchard spraying, miscible oil, kerosene oil emulsion and distillate oil emulsion proved successful. Miscible oil was efficacious in the strengths of 1 : 12 and 1 : 20, but 1 : 28 was only partially successful. Kerosene emulsion succeeded in the strengths 10, 15 and 20 per cent. Distillate oil emulsions at 3, $4\frac{1}{2}$ and 6 per cent. were efficacious, rather more than one U.S. gal. of wash being required for yearling trees. Carbon bisulphide, 20 cc. per tree, was injected in four places at from 8 to 12 inches from the trunk with good results, but there is some danger to the trees from the use of this insecticide. Treatment of infested trees in April or May is recommended, followed by examination during July and August and, if necessary, by a further treatment Manure round the trees helps to retain moisture and assists in combating this Aphid on heavy soils.

HECKE (G. H.). **Mealybug Control.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, vi, no. 10, October 1917, p. 397.

In consequence of the representations made by the citrus growers of southern California, a sum of about £1,000 has been allocated by the State Board of Control for the campaign against the citrophilus mealy bug [*Pseudococcus citrophilus*]. This fund will be expended, firstly, in work with natural enemies and the control of the Argentine ant [*Iridomyrmex humilis*], and, secondly, in the demonstration of orchard control methods in co-operation with the Citrus Experiment Station.

HUNDLEY (J. B.). **Sulphur Injury in Yucaipa, 1917.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, vi, no. 10, October 1917, pp. 402–407.

The week 12th to 19th June, 1917, following the time when the orchards of Yucaipa were extensively sprayed, was remarkable for a heat wave which was unprecedented in recent years, the temperature being 10 degrees higher than ever before known in the district, while the heat was accompanied by a desert wind, both dry and hot. This hot spell followed an exceptionally cold and rainy spring. The weather conditions are emphasised because they seem to have been the main factor in the spray-injury recorded. During the four years of work against the codling moth [*Cydia pomonella*], red spider and mildew, the same sprays have been used without any injury to fruit; in the present case no injury was apparent until the fifth day of the hot spell, which was from 10 to 20 days after the spray was applied. The leaves were then observed to fall in large numbers, while the fruit, where exposed to the sun, was severely scorched. The fruit continued to develop round the scorched area, but was badly misshapen. A great difference in susceptibility was noticed among the varieties of fruit. Tables are given showing the compositions of the sprays used, and it is evident that in practically every case where sulphur was used injury resulted, the brand employed apparently making but little difference. In no case was arsenate of lead, either with or without soap, found to cause any injury. A study of the results of these sprays indicates that there is danger in the use of sulphur in any form during the growing period. Lead arsenate-sulphur-soap sprays seem fairly

safe in dry climates when the temperature does not exceed 100°F.; above that point there seems to be an element of risk. It was noticed also that the most severe scorching occurred where the vitality of the trees was low, either owing to poor soil, lack of moisture or other unfavourable soil conditions. The injury under consideration seems therefore to have been caused by a combination of conditions, namely, sulphur, lack of vigour in the tree, and unusual heat.

Brosius (F. C.). **Wormy Pears are condemned in Sacramento County.** —*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento,* vi, no. 10, October 1917, pp. 408–410.

The pear crop of 1917 in Sacramento was unusually abundant, but was heavily infested with the larvae of codling moth [*Cydia pomonella*], the exact cause of the severity of the infestation being unknown. Entire consignments were sorted and repacked at the docks before shipment; a memorandum gives the percentage of infestation in each box counted and the number of boxes in each consignment that were condemned. It is intended in future not to allow over 3 per cent. infestation in any packed box of pears.

Maskew (F.). **Quarantine Division. Report for the Month of July, 1917.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento,* vi, no. 10, October 1917, pp. 413–414.

The following pests were intercepted:—From Central America: *Aspidiotus cyanophylli*, *A. cydoniae*, *Chrysomphalus scutiformis* and *Pseudococcus* sp., on bananas. From China: Weevil larvae in sweet potatoes; Lepidopterous larvae in dried herbs; weevil and Lepidopterous larvae in dried potatoes; weevils in roots. From Hawaii: *Diaspis bromeliae* and *Pseudococcus bromeliae* on pineapples; *Coccus longulus* on betel leaves; Trypetid larvae in mangoes and string beans; weevils in seed pods. From Japan: Coccids on a pot plant. From Mexico: weevil larvae in beans; *Calandra* sp. in maize; unidentified Lepidopterous larvae in dried bananas. From New York: *Diaspis boisduvali* on orchids; *Saissetia oleae* on Cycads. From New Jersey: *Hemichionaspis aspidistrae* on sago palm; *Diaspis boisduvali* on orchids; *Gymnaspis aechmeae* on *Vriesia speciosa*; *Aspidiotus cyanophylli* on *Ananas sativus* (pineapple); *Pseudococcus* sp. on *Medinilla magnifica* and dracaenas; *Eucalymnatus tessellatus* on palm. From Connecticut: *Pseudococcus* sp. on ornamental plants. From Pennsylvania: *Saissetia hemisphaerica* on gardenias. From South Sea Islands: *Pseudococcus* sp. on palms. From Tahiti: Coccids on oranges.

Gernert (W. B.). **Aphis Immunity of Teosinte-Corn Hybrids.**—*Science, Lancaster, Pa.,* xlvi, no. 1190, 19th October 1917, pp. 390–392.

Aphis maidi-radicis (maize root-aphis) and *A. maidis* (maize plant-aphis) are two very destructive species, there being probably no maize-growing region of importance in N. America that is free from the former, which sometimes causes total failure of the crop in limited areas. From eleven to twenty-two generations have been found in one season, and it is estimated that each individual hatched in the

spring may give rise to 319 billion offspring and 3 trillion eggs in the season. Hence the importance of the fact that *Euclanea mexicana* (teosinte) pollinated by *Zea indentata* (yellow dent corn) gives rise to a hybrid which is totally immune to attacks of these Aphids. This is probably due to the fact that the leaves of teosinte are tougher and with more serrate edges, and the sap of the plant is sweeter than that of *Zea indentata.*

UVAROV (B. P.). **Обзоръ дѣятельности мѣстныхъ организацій по борьбѣ съ вредителями въ 1914 году.** [Review of the Work of local Organisations for the Control of Pests in 1914.]—**« Сельское Хозяйство и Лѣсоводство.»** [*Agriculture and Forestry*], *Petrograd*, cclii, January-February 1917, pp. 131–151. [Received 16th November 1917.]

In 1910 there were only four Entomological Organisations in Russia (Simferopol, Kherson, Kharkov and Kiev), while in 1914 their number had increased to 21 permanent stations and bureaus, in addition to which entomological branches existed at five Agricultural Experiment Stations and in some Governments entomological work of a temporary nature was carried on. The total number of persons holding permanent appointments in the 21 establishments was 58, the staff usually including also a few temporary assistants engaged for the summer months. No exact data are available as to the cost of the local organisations, but they may be assumed to average £600–£700. Investigations on the local fauna and flora formed an important part of the work of the local organisations. In the majority of cases these were carried out by members of the staff and in some districts special observation points were established.

The author advocates the expansion of the latter type of investigations, as giving full and precise data on the life-history of a given pest. The stations and bureaus also collect information on pests and injuries to plants by means of a more or less developed system of local correspondents, in which respect special mention must be made of the Poltava Bureau, which in 1914 had no less than 597 correspondents.

The entomological organisations also conducted investigations on the pests specially injurious and dangerous in their respective districts and made experiments with various remedies and insecticides. Their practical work consisted in popularising knowledge of pests and their control by means of posters, pamphlets, lectures and demonstrations, in organising hiring stations for sprayers, etc., in replying to inquiries and generally advising the population, and, in some cases, in active participation in the campaign against various pests, of which large outbreaks occurred.

Уставъ Южно-Русскаго Энтомологическаго Общества. [The Foundation of the South Russian Entomological Society], *Odessa*, 1917, 7 pp.

The South Russian Entomological Society was founded in April 1917, for the purpose of studying theoretical and applied entomology. The headquarters of the Society is at Odessa, the President being Prof. D. K. Tretiakov and the Secretary Mr. A. V. Anutchin. The Society invites kindred organisations in other countries to communicate with it with a view to arranging an exchange of publications.

The Threatened Plague of Locusts.—*Jl. Bd. Agric. British Guiana, Demerara,* x, no. 3–4, April-July 1917, pp. 203–205. [Received 20th November 1917.]

The destructive South American locust, *Schistocerca paranensis*, has suddenly made its appearance in various parts of British Guiana and a notice has been issued by the Government economic biologist for general information, giving some account of the life-history and habits of this species and requesting that every effort should be made to destroy the swarms immediately on their appearance. Its favourite food-plants are said to be sweet and bitter cassava, maize, tannias, rice and sugar-cane, as well as a number of weeds.

The methods of control advocated include the collection, digging up and destruction of eggs and killing the hoppers at night, when they are found in dense masses, by surrounding them with dry foliage soaked in kerosene oil and burning them, or by driving them into a trench about 2 ft. wide and 3 ft. deep into which kerosene has been poured and which can then be ignited. A solution of 4 lb. arsenate of lead paste in 50 gals. water sprayed over the vegetation in the immediate line of advance of the locusts is very efficacious in killing them, while 1 lb. arsenite of soda dissolved in 4 gals. water with the addition of 2 lb. molasses has been found most successful in other parts of the world. Paris green in the proportion of 1 lb. to 5 lb. of lime may be dusted on the leaves on which the locusts are feeding. All poisons should be applied in the early morning. The absolute necessity for taking immediate action as soon as the swarms appear is emphasised, otherwise the entire cultivated areas of the colony are threatened.

Baker (A. C.). **Life-History of *Macrosiphum illinoisensis*, the Grapevine Aphis.**—*Jl. Agric. Research, Washington, D.C.*, xi, no. 3, 15th October 1917, pp. 83–89, 2 plates.

This paper describes the various forms of *Macrosiphum illinoisensis*, Shimer, of which *M. viticola*, Thos., is a synonym. This Aphid is widely distributed in the more southern of the United States. Eggs are deposited generally during October upon the twigs of *Viburnum prunifolium*, the favourite position being close to the buds; these hatch during late March and early April, giving rise to the stem-mothers. The young Aphids at once begin to feed on the buds and later assemble in the flower clusters and devour the blossom stems; they also feed to some extent on the twigs and leaves. The five instars of this form are described. Spring migrants appear in the second generation and are most abundant in the third in early May, after which they gradually decrease. These migrants fly to wild and cultivated grapes, being sometimes observed a mile distant from *Viburnum*. Summer wingless forms occur in great abundance throughout the summer, as many as seven generations frequently reaching maturity by 1st July, while the winged forms mature a day or two later. Both forms do considerable damage to vines, attacking the growing clusters and causing the berries to drop while still small and green. The growing shoots and leaves are similarly attacked and retarded in their growth. Intermediates between the summer winged

and wingless forms have been found on grapes. The winged forms produce an average of 6 young a day; the wingless from 6 to 10. Autumn migrants are produced upon grapes during early October, and during the following week are found depositing oviparous females upon *Viburnum*. The males are produced a little later than the autumn migrants, but are frequently found on *Viburnum* before the oviparous females are mature; during this period they feed upon the *Viburnum* leaves. Each oviparous female after pairing lays from 3 to 6 eggs.

MAZIÈRES (A. E. DE). **Culture de la Pomme de Terre sur le Littoral et dans les Régions élevées pendant et après la Guerre.** [Potato Cultivation on the Coast and in the hilly Regions during and after the War.]—*Rev. Hortic. de l'Algérie, Algiers*, xxi, no. 8–9, August-September 1917, pp. 131–142, 8 figs. [Received 22nd November 1917.]

Phthorimaea operculella does considerable damage in potato tubers set apart for seed, causing rapid decomposition among them. As a preventive, the potatoes should be sprayed with an arsenical mixture. As a check to the increase of the moth, all infested tubers should be destroyed by burning. Any sprouts appearing on the tubers should be cut off, as these are selected by the moths for oviposition. The crop should not be left long on the ground, while all contaminated leaves and field refuse should be carefully burnt. A species of *Tylenchus* attacks potatoes, but causes less damage to that crop than to tomatoes, beans or onions.

Experiments with a Parasitic Fungus of the Cacao Thrips.—*Rept. Agric. Dept. Grenada, 1916–1917; Barbados*, 1917, pp. 11–12.

Experiments with the fungus, *Sporotrichum globuliferum*, which has been found to infest the cacao thrips (*Heliothrips rubrocinctus*) [see this *Review*, Ser. A, iv, p. 250, and v, p. 268] have been continued. Cultures of the fungus were sprayed over infested trees in the cacao plot, and also on cacao plants in boxes. Considerable numbers of adult thrips were killed, while many nymphs and adults were found parasitised by the fungus. It is considered that the measure of success attending these experiments justifies more extensive trials in the field, for which arrangements are being made.

Insect Pests and Diseases.—*Rept. Agric. Dept., Grenada, 1916–1917; Barbados*, 1917, pp. 12–13.

The cacao thrips [*Heliothrips rubrocinctus*] was unusually numerous on cacao between September and December, 1916, after which the infestation gradually diminished, disappearing by the end of March. Leaflets were subsequently distributed among planters, reminding them of the importance of control measures before the next outbreak should occur. It is probable that experiments with Blackleaf 40 will be made on some estates. The frogbopper, *Tomaspis saccharina*, Dist., although not a serious pest of sugar-cane in Grenada, caused considerable damage in certain localities. Clean cultivation in the sugar-cane

fields is recognised as an important factor in preventing froghopper attacks, while the green muscardine fungus [*Metarrhizium anisopliae*] is very useful in keeping the pest in check. *Diatraea saccharalis* (sugar-cane moth-borer) seriously damaged maize in certain localities. Suitable control measures, including the protection of an insect parasite of the eggs of *D. saccharalis*, were carried out. *Thermesia gemmatalis* (woolly pyrol moth) was found in the larval stage destroying the foliage of horse beans (*Canavalia ensiformis*), but the attacks were of short duration. A Scolytid, probably *Xyleborus* sp., was observed boring in dead cacao twigs, but had probably begun its attack after the twigs were dead. *Diaprepes abbreviatus* (root borer) in the adult stage has damaged lime trees by eating the leaves ; these weevils had probably migrated from sugar-cane among which the limes grew, after completing their development in sugar-cane roots. Collecting the weevils, which fall to the ground when the trees are shaken, is being tried as a means of reducing their numbers. The snow scale [*Chionaspis citri*] and purple scale [*Lepidosaphes beckii*] have also injured limes ; at one station insecticides have kept these pests under control ; at another, natural control by the fungus *Cephalosporium lecanii* has proved sufficient. This fungus is now distributed throughout the island and, where climatic conditions are favourable, is exercising a very noticeable measure of control over the shield scale [*Coccus mangiferae*] on mangoes and the green scale [*Coccus viridis*] on limes. *Aspidiotus destructor* (Bourbon scale) has been very prevalent on coconut leaves ; cutting and burning badly infested leaves and spraying those left on the trees have given good results. *Pseudococcus* sp. (mealy bug) is not at present a serious pest, but steps should be taken to control it before it becomes more abundant.

Plant Legislation in Grenada.—*Rept. Agric. Dept. Grenada, 1916–1917 ; Barbados*, 1917, pp. 29–30.

This paper reviews the legislation passed during the years 1905–15 as precautionary measures against the introduction of plant pests and diseases into the island.

MUNRO (R. W.). **The Cultivation of Liberian Coffee.**—*Agric. Bull. Fed. Malay States, Kuala Lumpur*, v, no. 11–12, August–September 1917, pp. 431–438.

In discussing the possibility of reviving the cultivation of Liberian coffee, the author remarks that this crop has been out of favour for so long that it is not possible to conjecture what enemies are awaiting its reappearance in the event of its again being cultivated. In embarking upon such an enterprise growers should work on more scientific lines than the early coffee planters were able to do, and, as a preliminary, clean-clearing of the sub-soil timber should receive the consideration it deserves. Undoubtedly the bee hawk-moth [*Cephonodes hylas*, L.] would again appear as a pest of the coffee, and as a precautionary measure against its spread it is suggested that no large areas be planted without dividing belts.

Forbes (S. A.). **The Relations of Ecology and Economic Entomology.** —*Jl. Ecology, Cambridge,* v, no. 2, June 1917, p. 119.

The author argues that the methods and principles of ecology are fundamental to the study of economic entomology, which deals with the interactions, actual and possible, between insects and man, and that teachers of the latter should base their special courses on ecological pre-requisites.

Hood (J. D.). **An Annotated List of the Thysanoptera of Plummer's Island, Maryland.**—*Insecutor Inscitiae Menstruus, Washington, D.C.*, v, no. 4–6, April-June 1917, pp. 53–65.

The sixty-nine species of thrips dealt with in this paper include: *Limothrips cerealium*, Hal., feeding exclusively on grasses and cereals; *Frankliniella fusca*, Hinds (tobacco thrips), injurious to shade-grown tobacco in the South; *F. tritici*, Fitch (wheat thrips), probably the most abundant species in North America; *Anaphothrips obscurus*, Müller (grass thrips), abundant and destructive in Europe and North America, producing the familiar "silver-top" on many species of grasses; *Scolothrips sex-maculatus*, Perg., a species predaceous on mites; *Thrips tabaci*, Lind. (onion thrips), a very injurious cosmopolitan species; *Haplothrips statices*, Hal., an abundant and destructive species, described by Osborn under the name *H. nigra*, but identical with the European *H. statices*; *Zygothrips americanus*, Hood, occurring throughout the year under loose bark of every species of tree examined; *Trichothrips anomocerus*, Hood, often abundant under sycamore bark, and found under bark of grape; *Rhynchothrips tridentatus*, Shull, a common species on various oaks; *R. salicarius*, Hood, found at the base of young willow shoots, where it deforms the young leaves and retards the growth of the trees; *Leptothrips mali*, Fitch (*Cryptothrips aspersus*, Hinds), often seen preying on Aphids; *Idolothrips coniferarum*, Perg., abundant on red cedar; and *Neothrips corticis*, Hood, occurring abundantly under apple bark.

Dyar (H. G.). **Miscellaneous New American Lepidoptera.**—*Insecutor Inscitiae Menstruus, Washington, D.C.*, v, no. 4–6, April-June 1917, pp. 65–69.

This paper deals with seven new species, including *Vehilius sacchariphila*, sp. n., bred from larvae on blades of sugar-canes; *Datana diffidens*, sp. n., defoliating oaks; and *Eucymatoge spermaphaga*, sp. n., reared from larvae in cones of *Abies concolor.*

Girault (A. A.). **New Australian Chalcid-flies (Hymenoptera, Chalcididae).** — *Insecutor Inscitiae Menstruus, Washington, D.C.*, v, nos. 4–6 & 7–9, April-June & July-September 1917, pp. 92–96 & 133–155. [Received 10th November 1917.]

This systematic paper deals with 10 new genera and 44 species, 35 of which, together with one variety, are new. The species dealt with include *Coccophagus leptospermi*, sp. n., reared from galls on *Leptospermum flavescens*; *Bardylis australiensis*, How., from *Mytilaspis* on *Euphorbia*; *B. australicus*, sp. n., reared from *Aspidiotus*

rossi, *A. nerii*, and *Parlatoria proteus* on *Ficus*; *Apterotrix dubia*, sp. n., from *Fiorinia* on *Acacia*; *Aphycus coccidiphagus*, sp. n., from *Rhizococcus* (?) on *Leptospermum*; *Bucanusia margiscutellum*, sp. n., from *Lepidosaphes* (*Mytilaspis*) *casuarinae*, Mask., on *Casuarina*: *Zaommoencyrtus poeta*, sp. n., reared from a supposed Psyllid larva under the bark of *Eucalyptus*; *Amiscogaster ruskini*, sp. n., reared from a species of *Icerya*; *Dibrachys australia*, sp. n., reared from the larvae of *Cydia pomonella*; *Eurytoma casuarinae*, sp. n., reared from galls on *Casuarina*; *Aceratoneuromyia australia*, sp. n., associated with the fruit fly; *Dinoura eucalypti*, sp. n., reared from a Chalcid in galls on *Eucalyptus*; and *Parachrysomalla secunda*, sp. n., from turpentine galls.

THOMPSON (W. R.). **Sur un Diptère parasite des Isopodes terrestres** (*Phyto melanocephala*, **Meig.**). [On a Dipterous parasite of terrestrial Isopods.]—*C. R. Soc. Biologie, Paris*, lxxx, no. **16**, 20th October 1917, pp. 785–788, 7 figs.

It has long been suspected that some flies pass their larval stages parasitically in certain terrestrial Isopods. In 1840 the larva of *Stevenia umbratica*, Fall., was recorded as parasitising *Oniscus asellus*, L., another species, *S. atramentaria*, Meig., being reported from the same host. In 1903, some Dipterous pupae were found in the empty skin of an American Isopod; and in 1908, from two pupae found in the Isle of Wight in specimens of *Oniscus asellus*, the adults of *Phyto melanocephala*, Meig., were reared.

In this note the author deals with four species of woodlice, *Porcellio scaber*, Latr., *Oniscus asellus*, L., *Armadillidium vulgare*, Latr., and *Philoscia muscorum*, Scop., from the neighbourhood of Portsmouth, in the last two of which no parasites were found, while the others yielded larvae of *Phyto melanocephala*.

The parasite penetrates the body of its host probably towards autumn, and hibernates in the first or second stage according to the size of the host, the third larval stage being entered upon at the beginning of summer, except in the case of those that have hibernated in the first stage, the development of which is slower. After feeding on its host, the parasite pupates in its skin, in which stage it is itself often attacked by an Ichneumonid, and the adult fly emerges a fortnight later. Parasitism by this form results in the atrophy of the genital organs of the host.

The author deals at length with the anatomy of the three larval stages and shows that the first of these closely resembles *Sarcophaga* and *Onesia*, from which, however, it differs in many important particulars. It also shows a striking resemblance to the larva of *Digonichaeta setipennis*, but differs from all other Muscid parasites of Arthropods so markedly as to constitute a type at present unique.

MALENOTTI (E.). **I Nemici naturali della "Bianca-Rossa"** (*Chrysomphalus dictyospermi*, **Morg.**). [The natural Enemies of *C. dictyospermi*.]—Separate, dated 29th October 1917, from *Redia, Florence*, xiii, no. 1, pp. 17–53, 2 plates.

The natural enemies of *Chrysomphalus dictyopermi*, Morg., hitherto recorded are a fungus, a predaceous Trombidiid mite, six predaceous

beetles, and several parasitic Chalcids. Little practical value attaches either to the *Cladosporium* fungus, or to the Trombidiid mite, *Allothrombium gymnopterorum*. Of the Coccinellids, three are species that have been imported into Italy, namely, *Rhizobius lophantae*, *R. ventralis* and *Orcus chalybaeus*. Up to the present their practical importance has not been proved. The indigenous species are *Chilocorus bipustulatus* and *Exochomus quadripustulatus*, and the Nitidulid, *Cybocephalus rufifrons*, Reitter. *C. bipustulatus* is unimportant in Italy because its increase there is checked by two parasites, *Tetrastichus epilachnae*, Giard, and *Homalotylus flaminius*, Dalm.; in Spain it appears to be a useful enemy of the scale.

A description of the seven Chalcid parasites of *C. dictyospermi* occupies the greater part of this paper. The four ectophagous species, *Aphycus hesperidum*, Mercet, *Signiphora merceti*, Malen., *Aphelinus chrysomphali*, Mercet, and *A. silvestrii*, De Greg., are accidental enemies, at least as concerns *C. dictyospermi*. Of the endophagous species, *Aspidiotiphagus citrinus*, How., is usually also an accidental enemy, *A. lounsburyi*, Berl. and Paol., is still being tested, and the very recent discovery of *Prospaltella fasciata*, Malen., taken (together with *A. citrinus*) from *C. dictyospermi* on *Sansevieria arborescens* at Florence, precludes any estimate of its practical value. While awaiting the help of natural enemies recourse must be had to insecticides, of which Del Guercio's colloidal polysulphide of calcium has proved to be the best. Full directions for preparing this spray have already been given [see this *Review*, Ser. A, iv, p. 146].

MALENOTTI (E.). ***Casca luzonica*, Malen., n. sp., Endofago di *Schizaspis lobata*, Ckll. e Rob.** [*Casca luzonica*, sp. n., an endophagous Parasite of *Schizaspis lobata*.]—Separate, dated 9th November 1917, from ***Redia*, *Florence***, xiii, no. 1, pp. 73-76, 6 figs.

Casca luzonica, sp. n., which is described and figured in this paper, is a parasite of *Schizaspis lobata*, Ckll. & Robinson, infesting the leaves of *Ficus nota* in the island of Luzon, Philippines.

SCHOEVERS (T. A. C.). **Biologische Bestrijding van schadelijke Dieren.** [Biological Measures against injurious Animals.]—***Wageningen***, 1917, 8 pp.

This paper, read on 24th April 1917 before the Society of Natural Science at Wageningen, comprises a brief review of the utilisation of beneficial insects against injurious species.

SCHOEVERS (T. A. C.). **Wormstekigheid in Appelen en Peren.** [Worminess in Apples and Pears.]—***Tijdschr. Plantenziekten*, *Wageningen***, xxiii, no. 4, August 1917; Bijblad, pp. 1-14, 2 plates. [Received, 15th November 1917.]

This paper contains full instructions for combating *Cydia* (*Carpocapsa*) *pomonella* in Holland. The use of band-traps is advised, especially those in which depressions have been stamped into both sides of thick paper. Winter spraying with carbolineum is a very simple and cheap means of combating this pest, but until all growers

adopt it, spring spraying with lead arsenate must be continued in order to protect the fruit against individuals that have not been killed in winter. Tits render valuable aid in destroying this moth.

Injury to apple by the saw-fly, *Hoplocampa testudinea*, Klug, and to pear by *H. brevis*, Htg., closely resembles that caused by *C. pomonella*. The destruction of infested fruit is the only known check on these pests. Apples are sometimes, but only rarely, attacked by *Argyresthia conjugella*, Z.

RITZEMA-BOS (J.). **De Koolzaadglanskever** (*Meligethes aeneus*, **L.**). [The Seed-Cabbage Beetle.]—*Tijdschr. Plantenziekten, Wageningen*, xxiii, no. 4, August 1917; Bijblad, pp. 22–24. [Received 15th November 1917.]

In reply to an enquiry the author expresses the opinion that cabbages for seed may safely be re-planted in ground where the previous crop has been destroyed by *Meligethes aeneus*, L., because this beetle constantly occurs on cabbage and becomes dangerous only when the growth of the plants is retarded by drought or by inclement weather. Furthermore, as soon as the flowering of the cabbage is over, the beetle migrates to other plants.

BERNARD (C.). **Over eenige Ziekten en Plagen van de Thee op de Oostkust van Sumatra.** [Some Diseases and Pests of Tea on the East Coast of Sumatra.]—*Meded. Proefstation voor Thee, Buitenzorg*, no. 54, 1917, pp. 1–21, 7 figs.

The first section of this paper deals with the root diseases of tea and the second is devoted to various pests of this plant. These include a black Aphid, Curculionid beetles and the mites, *Tarsonemus translucens*, *Eriophyes* (*Phytoptus*) *carinatus*, *Tetranychus bioculatus*, and *Brevipalpus obovatus*. The larvae of *Cania bilinea*, which feed on the tender tissues of the leaves and twigs, have caused serious loss in some plantations and another Limacodid, *Belippa bohor*, also damaged the foliage. The larvae of *Attacus atlas* and *Chaerocampa alecto* were seldom seen, but *Stauropus alternus* (lobster caterpillar) was collected in large numbers. The larvae of *Ophiusa melicerta* and *Euproctis latifascia* are only of occasional occurrence. It is necessary to watch for and destroy immediately, *Clania variegata*, *C. crameri*, *Acanthopsyche snelleni* and other Psychids. In a nursery the author has also observed a very small species of *Acanthopsyche*, probably *A. subteralbata*, which has already been noticed on *Albizzia* and tea in Java. *Parasa lepida*, *Dasychira mendosa*, *Thosea recta* and *T. cervina* were also seen. *Zeuzera coffeae* (red borer) sometimes injured the young twigs. Leaf-rollers also occur, but are not to be feared so long as the tea plants are vigorous. The looper caterpillar, *Buzura* (*Biston*) *suppressaria*, is also unimportant. The larva of *Lawana*, which sometimes infests *Grevillea*, is only very exceptionally found on tea. In spite of all the measures adopted in Java the tea-seed fly [*Adrama determinata*, Walk.] is still imported into the East Coast of Sumatra and might become dangerous were it not for the ease with which it can be controlled [see this *Review*, Ser. A, iii, p. 434].

The third section deals with *Helopeltis* and *Pachypeltis*, both of which may develop into serious pests of tea on the East Coast of

Sumatra. *Helopeltis sumatranus* was noticed on *Uncaria* (gamhir), as was also recorded by Roepke some years previously. This species attacked leaves of tea which were placed in a cage with *Uncaria* leaves, and as no preference was shown for the latter, it is evident that tea is a suitable food-plant. *Helopeltis antonii* was observed on *Eugenia malaccensis*. A species of *Pachypeltis*, believed to be *P. humeralis*, was seen on many plants (*Vitis*, etc.) growing near tea and in some instances the tea foliage had been attacked, though not seriously. While it is by no means certain that these three species will prove injurious in Sumatra, where the tea plants are very vigorous, co-operative preventive measures should not be neglected. The importation from Java of cacao pods and of tea, cinchona and cacao plants should be prohibited in order to restrict the introduction of *Helopeltis antonii* and to prevent that of other species of *Helopeltis* and of *Pachypeltis vittiscutis*. The vigorous growth of gambir and tea should be promoted and these plants should be thoroughly pruned in the manner suggested by Leefmans [see this *Review*, Ser. A, v, p. 416].

The fourth section of this paper deals with *Brevipalpus obovatus* (orange mite) which in Java causes serious damage on estates at or above an altitude of 3,300 feet. In Sumatra the plantations are below that limit, so that serious injury need not be apprehended. Preventive measures are advised, however, on the first appearance of this pest in the high-lying estates, in some of which infestation of some consequence was observed.

Appended to this paper is a circular on *Helopeltis sumatranus* by Mr. A. A. H. Rutgers, Director of the Experiment Station of the East Coast of Sumatra Rubberplanters' Association. Though *H. sumatranus* has been found only on gambir up to now, experiments showed tea leaves to be attacked three times as much as gambir leaves. The occurrence of this Capsid in plantations may be detected by observing the presence of small (2–3 mm.) black spots on the very young leaves. The insect itself is best sought for early in the morning and is easily recognisable from the presence of a spine projecting from the back between the base of the wings.

A second appendix is a systematic paper by S. Leefmans entitled "Some Capsids found in Sumatra," which describes the three species dealt with in the third section of this paper.

Rivière (C.). **Extraits des Procès-verbaux des Séances générales de la Société : Entomologie.** [Extracts from the Minutes of the General Meetings of the Society : Entomology.]—*Bull. Soc. Nat. Acclimat. France, Paris*, lxiv, no. 10, October 1917, pp. 401–402.

The spread in Northern Africa of some insects that have become endemic is occupying considerable attention. *Phylloxera* is spreading to such an extent that European vines are rapidly disappearing and the reconstruction of the vineyards with American stocks is an urgent necessity. A polyphagous Coccid, *Chrysomphalus dictyospermi pinnulifera*, Walk. (*minor*, Berl.), is a serious pest on orange-trees and on the small-leaved species of *Ficus*, and resists every form of treatment, which is in any case difficult on large trees. The author contends that laboratory methods should be abandoned and some practical method sought for the control of this pest and also for the

olive fly, *Dacus oleae*, which so severely infested the trees in 1916 that in some localities the crop had to be gathered unripe. *Ceratitis capitata*, Wied., which is now endemic, infests many fruits such as oranges, mandarines, persimmon, etc.

A useful insect that gives rise to the gall so much sought after in Morocco for the preparation of leather, has now been determined as a species of *Eriophyes* [*E. tlaiae*] [see this *Review*, Ser. A, v, pp. 191, 291]. In any case, the planting of tamarisk is only advantageous if the insect is imported with the plant, which has not always been the case.

D'UTRA (G.). **Enfermedades del Algodonero.** [Diseases of Cotton.]—*Rev. Agricola, Bogotá*, iii, no. 10, October 1917, pp. 592–596.

This is part of a popular article on the following four insect pests of cotton in Brazil: *Alabama argillacea*, *Heliothis obsoleta* (*armigera*), *Pectinophora* (*Gelechia*) *gossypiella*, and *Anthonomus grandis*, the first two species being dealt with here.

FULLAWAY (D.). **Division of Entomology.**—*Hawaiian Forester & Agriculturist, Honolulu*, xiv, no. 9, September 1917, pp. 258–259. [Received 27th November 1917.]

During the month of August the beneficial parasites distributed were 750 *Opius fletcheri* (melon fly parasite); 45 *Galesus*; 400 *Tetrastichus*; and 3,650 *Paranagrus* (corn leaf-hopper egg-parasites).

EHRHORN (E. M.). **Division of Plant Inspection.**—*Hawaiian Forester & Agriculturist, Honolulu*, xiv, no. 9, September 1917, pp. 259–261. [Received 27th November 1917.]

During the month of August 40 bags of rice from Japan infested with the rice weevil [*Calandra oryzae*] and *Tenebroides mauritanicus* (meal beetle) were fumigated with carbon bisulphide for 48 hours. Other pests intercepted were *Prenolepis longicornis*, a nest of these ants being found in a crate of vegetables; the peach moth on peaches and Aphids on ornamental plants from San Francisco; Psyllids on forest trees from Australia; and a scale-insect on coconuts from Fanning Island. Four boxes of turnips infested with radish maggot [*Chortophila brassicae*] were ordered to be dumped at sea.

SANDERS (J. G.). **Crop Pest Controls.**—*Pennsylvania Dept. Agric., Bur. Econ. Zool., Harrisburg*, Circulars nos. 3 & 4, 22nd June 1917 & 15th September 1917.

These two circulars contain reprints of a series of notes on crop pests that have appeared in the "Weekly Press Bulletin" of Pennsylvania and have already been dealt with in this *Review*.

LEGISLATION.

The Pest Act in Mysore.—*Planters' Chronicle, Bangalore,* xii, no. 40, 6th October 1917, pp. 500–501.

The passing of the Destructive Insects and Pests Regulation in Mysore has provided that State with the first legislation of this nature that exists in India. The text of the Bill is quoted verbatim; it applies to the whole of Mysore, the Government having the right to declare any specified area or locality within the State to be infested. The Government may order the seizure, inspection, disinfection or destruction of any crops that are declared infested, and may provide for the treatment or destruction of such crops within a notified area, granting adequate compensation in suitable cases. Orders may be issued prescribing the cleansing and disinfection of infested areas, forbidding the planting or re-planting of any particular crop within a notified area, prohibiting the movement temporarily of crops, soil, manure, etc., in or out of a notified area, and taking general measures for preventing the spread within the State of any plant disease. Penalties are to be inflicted for any infringement of these regulations.

Agricultural Legislation in Pennsylvania.—Leaflets nos. 124 & 236. [N.D.]. [Received 10th December 1917.]

An Act approved on 17th May 1917, which is given verbatim, forbids the manufacture, sale or transportation within the Commonwealth of adulterated or misbranded Paris greens, lead arsenates, lime-sulphur compounds, and other insecticides and fungicides, and regulates the trade in these commodities, providing for their inspection and imposing fines for any infringement of the law.

A further Act, approved on 29th June 1917, which is quoted in full, provides for the protection of agriculture and horticulture by preventing the introduction into and the dissemination within the Commonwealth of insect pests and diseases injurious or harmful to plants or plant products. The inspection of nurseries is provided for, the necessary quarantines are established and penalties are imposed for infringement of the Act.

The Sweet Potato Root Weevil.—*Agric. News, Barbados,* xvi, no. 405, 3rd November 1917, p. 347.

It has recently been recorded that *Cylas formicarius* (sweet potato root weevil) has lately become established in certain districts in the State of Florida. A public notice has now been issued by the State Plant Board of Florida declaring *C. formicarius* an insect pest that is likely to attack sweet potato plants, vines, slips, cuttings, draws and tubers and morning glory (*Ipomoea* sp.) vines and roots. Certain areas within the State are declared to be infested and the movement or shipment of any of the above parts of these plants from the infested areas is prohibited. Sweet potato tubers may, however, be shipped after fumigation under the inspection of the Plant Board and when securely sacked and shipped in tightly closed cars in carload shipments.

Fryer (J. C. F.). Insect Pests of Basket Willows.—*Jl. Bd. Agric., London,* xxiv, no. 8, November 1917, pp. 844–852, 9 figs.

Few plants are more subject to the attacks of insects than willows or osiers. The more destructive species occurring in Great Britain include several Aphids, which are perhaps the most serious pests, as by sucking the plant-juices they stunt both leaves and rods, as well as coating the leaves with honey-dew and thus encouraging sooty mould. Some of the common species, such as *Siphocoryne capreae* and *S. pastinaceae,* have certain Umbelliferous weeds for alternate host-plants, *e.g.,* hemlock, wild parsnip, etc., these should therefore be carefully eradicated. *Aphis saliceti* and *Pterocomma pilosa* are also abundant on the leaves and shoots, while *Melanoxantherium salicis* is the most common species on the rods.

Willow beetles include *Phyllodecta vitellinae* and *P. vulgatissima,* which first appear in spring and early summer, when they attack the developing shoots and leaves, causing great injury by eating into the growing point of the rod. Eggs are laid on the under-surface of the leaves, which the larvae devour until fully developed, when they drop to the ground and pupate. There are two overlapping broods in a year, the adults of the second generation hibernating in rubbish on the ground or in crevices in pollard willows and attacking willows again in the following spring. *Galerucella lineola* is similar in life-history and habits to *Phyllodecta* spp., but hibernates in damper places. *Cryptorrhynchus lapathi* (willow weevil) has been previously described [see this *Review,* Ser. A, ii, p. 192]. It attacks alder as well as willow, and in addition to the damage to the rods by adult beetles, the larvae injure the stumps. *Aromia moschata* (musk beetle) is not a serious pest, although a conspicuous insect; it feeds in pollard willow trees and in old willow stumps.

Pteronus (Nematus) salicis and other sawflies are very occasionally found damaging willow leaves in Great Britain. *Pontania gallicola* and similar species are the cause of the red and green galls so often found on willow leaves; the larvae live in the gall and, when fully fed, make their way out and pupate in the soil. The injury is seldom serious.

The caterpillars of several moths feed on willow, but few of these are injurious to any extent. In Somerset, *Hypermecia cruciana* and *Depressaria conterminella* do some damage, the larvae spinning nests at the tips of the growing rods and feeding on the buds and leaves. Some moths, such as *Trochilium bembeciforme* (willow hornet clearwing) and *Aegeria (Sesia) formicaeformis* (red-tipped clearwing), in the larval stage live mainly in the stumps, pupate in the burrows and emerge as adults in June and July.

Several species of midges produce galls in the terminal buds. There are generally two generations in a year and it is believed that the winter is spent in the larval stage within the galls. *Rhabdophaga (Cecidomyia) heterobia* and *R. (C.) rosaria* are both gall-forming midges, while *R. (C.) saliciperda* (willow wood midge) burrows in the rods, the larvae pupating in the burrows.

General control methods may be used against several of these pests. Direct measures against beetles or caterpillars involve the use of some kind of poison spray for the leaves. Lead arsenate has been tried, but

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on basket willows in Britain has proved a complete failure. A nicotine-soap solution has been found efficient, and this is also the best contact insecticide for Aphids and destroys to some extent the moth caterpillars in the shoots. Sometimes as many as three applications are made, but if the willows are well sprayed in late May or early June, it is seldom necessary to spray again in the same year. A form of the Continental apparatus by means of which insects are shaken off the trees into trays might be of service in the case of *Cryptorrhynchus lapathi*, against which sprays are useless. Against the midges causing "button top" no successful treatment has been found, but assuming that the insects pass the winter in the buttons it is undesirable that infested rods should be left in the neighbourhood of the beds until the late spring, when the midges will emerge and attack the new crop. Precautionary measures include the burning of all rubbish, old bark, etc., during the winter, while old pollarded willows should not be allowed to remain close to willow beds, as they are invariably infested by willow-feeding insects of all kinds. Neglected and decayed willows, poplars or alders are all undesirable in the neighbourhood of willow beds. Willow stumps that are partly dead or weak should be removed and burnt as soon as the rods are cut.

STOREY (G.). **Machines for the Treatment of Cotton Seed against Pink Boll Worm (*Gelechia gossypiella*, Saund.)**—*Minist. Agric., Cairo,* Tech. & Scient. Service, Bull. no. 14 (Entom. Sect.), 23rd July 1917, 29 pp. [Received 23rd November 1917.]

The question of destroying the larvae of *Pectinophora* (*Gelechia*) *gossypiella* (pink bollworm) in cotton seed has occupied the attention of the entomological section of the Ministry of Agriculture in Egypt since 1912, and since the passing of the law which makes the treatment of cotton seed against this pest compulsory, a great many suggestions for machines for treating cotton seed have been received. These are all briefly described in this paper.

Fumigation is frequently objected to on account of the poisonous nature of the gases used and the danger involved in the process. The fumigating machines described include the Ministry of Agriculture's original machine [see this *Review*, Ser. A, iii, p. 505], and one proposed by M. Gayet, both involving the use of carbon bisulphide; M. Mosseri's fumigator, and an adaptation of the American baled cotton fumigator, both employing hydrocyanic acid gas, and a machine proposed by Messrs. Wells and Hayman, in which the fumes from the distillation of cotton sticks are used as the killing agent.

With regard to hot-air machines, some general problems in connection with this method of treatment are discussed. The difficulty of answering the question as to what temperature kills the larvae and what length of time is necessary, is illustrated by a table recording experiments which show the mortality of the caterpillars at different temperatures with various methods of treatment. Examination of these results leads to the conclusion that if seed be maintained for five minutes or more at the maximum temperature actually reached by the seed containing the larvae, the latter are killed at temperatures from about 124° F., upwards. If, however, the seed be immediately cooled after reaching its maximum, a temperature of at least 140° F. is

necessary. With regard to the minimum temperature that is fatal to the larvae and injurious to the seed, Table II gives a similar set of figures for the germination of treated cotton seed to those given in Table I for the mortality of the caterpillars. The results indicate that provided neither the whole mass of seed nor individual seeds are heated to a higher temperature during the treatment, wet seed can safely be raised to a temperature of 140° F., and dry seed to a temperature of at least 150° F. without affecting germination. Moreover, seed at these temperatures can safely be sacked in spite of the slow cooling of cotton seed in bulk. Questions regarding the controlling of the temperature during treatment are discussed.

The machines considered in detail are classed as follows:—
(1) Machines in which the seed is heated by a current of hot air. These include the Ministry of Agriculture's hot-air machine [see this *Review*, Ser. A, iv, p. 472]; the Hess Drier, which is a modification of an American machine used for conditioning maize, and which, while being the most economical of all to run, promises, with slight modifications, to prove satisfactory. The Neumancantelli hot-air machine is an ingenious device consisting of six cylinders on a revolving base, which at definite intervals is moved round automatically until each cylinder occupies the position held previously by the one next to it, so that the seed is treated in six stages. Unfortunately, it was found impossible in practice to get a sufficiently rapid current of air to raise the temperature of the seed at a reasonable pace. The inventor of this machine has since submitted another design, in which the seed is passed down a series of revolving discs and travels from the centre to the circumference of each, passing altogether over a distance of 40 to 45 metres on the surface of the discs. No machine of this kind has been completed, but it seems probable that, in its present form, the seed may remain too long in direct contact with the steam-heated surface of the discs and thus become damaged.

(2) Machines in which the seed is heated by radiation from steam pipes. These include the Domains' machine [see this *Review*, Ser. A, iii, p. 505], and Matsouchis' (Planta's) machine, consisting of a series of long axles with radiating blades, arranged one above the other, alternate axles revolving in opposite directions. During its journey from blade to blade the seed is heated by radiation from steam tubes. This machine is not yet completed: the heating by radiation should involve less danger of overheating individual seeds, but a disadvantage lies in the necessity for a very much larger heating surface for the same output.

(3) Machines in which the seed is heated by direct contact with metallic heating surfaces. These include Simon's machine [see this *Review*, Ser. A, iv, p. 491]; Lenzi's machine, which is the simplest form of seed-heating, consisting of a long, narrow cylinder, steam-jacketed all round, in which revolves an axis with propeller blades that force the seed from one end to the other. Seed treated at 132° F. showed complete mortality of the larvae, but about 5 per cent. of the seed was damaged, probably by too long contact with the heating surface. By keeping the seed in more rapid motion this defect should be remedied and the machine found satisfactory. Macri's machine, which is very similar to the above, gave satisfactory results, though some minor improvements are recommended. Baker's machine is also similar, but the cylinders through which the seed passes, instead of

being heated individually by steam-jackets, are heated collectively in a gas-oven. No machine of this type has yet been erected, but it should prove satisfactory and particularly easy to control, the maintenance of a steady temperature in a gas-heated machine being a very simple matter. The Egyptian Engineering Co.'s (Murdoch's) machine is a somewhat novel type, which has been erected experimentally. It consists of a central heating cylinder surrounded by an outer cylinder, the space between being divided by longitudinal partitions into three sections, along which the seed is propelled by means of oblique flanges fixed on the inner surface of the outer cylinder. Five divisions are suggested as an improvement on three. The machine is said to be cheap and easy to construct, but would be rather more bulky than most of those described above.

Further experiments with Dell's Mechanical Cleaner [see this *Review*, Ser. A, iii, p. 505] confirm the opinion that this machine is not to be recommended for treatment against the pink bollworm, but might prove very useful for separating good seed from bad.

Bats as Guardians of Cotton.—*Agric. News, Barbados,* xvi, no. 405, 3rd November 1917, p. 344.

A correspondent from Bahia, Brazil, has found the best method of dealing with bollworms, cutworms and other larvae of night-flying moths, to be the establishment of colonies of insectivorous bats. A dark hut, with a few cross poles near the roof, will soon attract numbers. Colonies have been established in this way in Texas for the purpose of combating mosquitos and at the same time for producing guano [see this *Review*, Ser. B, i, p. 176]. In cotton districts it might be worth while to try a similar experiment. It must be remembered, however, that the fruit-eating bats would be useless for this purpose, and experimenters, who would find them more abundant in the West Indies than the smaller insectivorous species, must be careful not to encourage them.

HUTSON (J. C.). **The Pink Boll Worm** (*Pectinophora* [*Gelechia*] *gossypiella*, **Saunders**).—*Agric. News, Barbados,* xvi, no. 405, 3rd November 1917, pp. 346–347.

This paper comprises a résumé of the life-history and distribution of the pink bollworm, *Pectinophora gossypiella*, with some account of the losses caused by this important pest of cotton. In 1911, it was estimated that the annual loss in India due to this moth was £2,000,000.

In a future paper it is intended to refer to the measures that have recently been taken in the British West Indies to guard against the introduction of the pest into the islands.

The Black Weevil Borer of Bananas.—*Agric. News, Barbados,* xvi, no. 405, 3rd November 1917, p. 347.

With reference to the suggestion that sliced banana bulbs may be used as a trap for the banana weevil, *Cosmopolites sordidus* [see this *Review*, Ser. A, v, p. 435], it is stated that such traps are now in use in several localities in Jamaica and in one place as many as 2 quarts of weevils were collected by this means on an area of half an acre.

In this way the presence of the pest and its distribution throughout the islands may also be ascertained. It is hoped that experiments in this direction will be made by agricultural officers wherever possible.

The employment of good cultural methods is resulting in an appreciable reduction in the numbers of the borer in what were previously badly infested districts.

Baker (A. C.), **On the Chinese Gall (Aphididae—Hom.).**—*Entom. News, Philadelphia*, xxviii, no. 9, November 1917, pp. 385–393, 1 plate.

The galls produced by an Aphid on *Rhus semialata* have for many centuries been an important article of commerce in China, where they are employed in dyeing and tanning and in native medicines. They have also been largely exported and at present are one of the principal ingredients of the dyes used for sealskin in London. Although the product is well known, literature relating to the insect causing the galls is scattered and difficult of access. This paper brings together the chief information published about this Aphid, which is compared with the allied American species. There are many references to this Aphid in Chinese literature, particularly medical, dating back to the 16th century. The life-history of this species in Japan was studied in 1910 by Sasaki. A stem-mother was taken forming a gall on the under-surface of a leaf petiole in May. These stem-mothers produce 17 or 18 young. By the end of June the galls are divided into chambers; projections then begin to appear on the galls, usually with two young in each. Towards the end of August the galls contain numerous females of the second generation and many young of the third; in October, young of the fourth generation are present and nymphs begin to appear. During October and November the galls open and the alate forms escape. It is thought that this occurs when male winged insects are developed, this generation forming new galls in the following spring.

This insect was described by Bell in 1848 as *Aphis chinensis*. Walsh, in studying a Virginian species allied to *A. chinensis*, in 1866, erected the genus *Melaphis* with *M.* (*Pemphigus*) *rhois*, Fitch, as the type, this species forming a bladder-like gall on the under-side of the leaves of *Rhus glabra*. The life-history, habits and structure of the American and Chinese species referred to are so similar that the latter must also be placed in this genus. A bibliography of 35 works is given.

Tucker (E. S.). **Outbreaks of the Elegant Looper** (*Philtraea elegantaria*, **Hy. Edw.) on Privet in Louisiana (Lep.).**—*Entom. News, Philadelphia*, xxviii, no. 9, November 1917, pp. 394–396.

In May 1913 a severe infestation of a Geometrid caterpillar, *Philtraea elegantaria*, was observed on Amur privet (*Ligustrum amurense*). The adults appeared in June. Hymenopterous parasites destroyed a large proportion of the pupae, the most important being *Chalcis ovata*, Say, and *Eutelus* sp. A Tachinid parasite, of which only one female specimen was observed, proved to be *Euphorocera claripennis*, Macq.

DAVIDSON (W. M.). **Early Spring Syrphidae in California and a new *Pipiza* (Dip.).**—*Entom. News, Philadelphia*, xxviii, no. 9, November 1917, pp. 414–419, 1 fig.

Among the Syrphids dealt with in this paper, *Pipiza californica*, sp. n., is described. The larvae are aphidophagous, a male fly having been reared from a larva found feeding upon *Pemphigus populicaulis*, Fitch.

BALLARD (E.). **Notes on the Life-History of *Megacoelum stramineum*, Walk.**—*Madras Agric. Dept. Year Book 1917*, *Madras*, 2nd February 1917, pp. 83–87, 2 figs.

The Capsid bug, *Megacoelum stramineum*, presumably occurs all over India and in the Madras Presidency is commonly found on cholam (*Andropogon sorghum*), on which it feeds, ovipositing in the ripening grain. The injury it does is not so great as that caused by another bug, *Calocoris angustatus*, with which it is nearly always found, and which damages the immature and unfertilised florets. Cholam grown under irrigation during the hot weather does not appear to be heavily infested, but the insect has been found hiding in the central leaf-whorl of young cholam and cumbu, and has been observed on various other crops such as ground-nut and gingelly (*Sesamum indicum*).

The eggs, which are provided with a conspicuous white ridge or collar, part of which forms a tag-like prolongation, under natural conditions are laid one in each grain. They hatch in 6 or 7 days and maturity is attained in 10 or 11 days after five moults; the females are very prolific, the number of eggs deposited by each being from 150 to 200.

No effective methods have yet been devised for destroying or checking this pest, and with the exception of an Acarid found infesting an adult female in one case, no natural enemies have been recorded.

RAO (Y. R.). ***Adisura atkinsoni*, Moore.**—*Madras Agric. Dept. Year Book 1917*, *Madras*, 2nd February 1917, pp. 87–91, 1 fig.

This Noctuid moth is a pest of *Dolichos lablab* throughout the Madras Presidency where it also attacks red gram (*Cajanus indicus*) to a small extent. The eggs are laid singly either on the pods or on the flower-buds and hatch in three days. The caterpillar, which is full-grown in eight days after four moults, is capable of doing much damage, often attacking several pods in succession. It may be easily distinguished from the larva of *Heliothis* (*Chloridea*) *obsoleta*, which also feeds on lablab and red gram, by its comparatively smooth skin and its habit of entering bodily into the pods. In from 4–6 days the larva leaves the pod and pupates in an oval earthen chamber in the soil, the moth emerging 11 days later. It breeds only in the cold weather, following the habits of lablab and red gram which fruit only during the cold months.

The caterpillar is parasitised by a yellowish Braconid (? *Rhogas* sp.), which is itself attacked by a Chalcid hyperparasite.

RAMAKRISHNA AYYAR (T. V.). **A new Pest of the Coconut Palm on the West Coast, *Contheyla rotunda*, Hmp.**—*Madras Agric. Dept. Year Book 1917, Madras,* 2nd February 1917, pp. 91–96, 2 figs.

The Limacodid moth, *Contheyla rotunda*, although known to coconut cultivators for several years as doing insignificant damage to the leaf-tips, had never been recorded as a pest until December 1915, when reports of damage due to it were received simultaneously from some seaside villages in the Cochin State, and from south Malabar, a second outbreak in the latter district occurring in February 1916. The caterpillars are gregarious and in bad cases skeletonise the coconut fronds, the more mature leaves of older trees being chiefly affected.

The life-history is as yet imperfectly known. The eggs are laid in groups on the leaf-surface, each adult female being capable of producing from 50 to 170. They hatch in about four days, the full-fed larva constructing a brown shell-like cocoon within which it pupates, a generation from egg to adult taking approximately six weeks, while there are at least two generations in the year. So far no other host-plant has been found, though it is not unlikely that other palms may serve this purpose. A Chalcid and a Braconid parasite have been found attacking the larvae.

The easiest and most practicable method of control is that carried out by the natives, which consists in cutting away and burning the affected fronds early in the season. Spraying with arsenate of lead is impracticable in the case of large trees with mature foliage, which are the only ones that the pest attacks.

RAMAKRISHNA AYYAR (T. V.). **Note on the Egg-laying Habits of the Agathi Weevil, *Alcides bubo*, Fb.**—*Madras Agric. Dept. Year Book 1917, Madras,* 2nd February 1917, pp. 97–99.

Alcides bubo, F., has often been noted as a serious pest in betel vine gardens on *Sesbania* (agathi), where the latter is grown as a standard for the vines, while it also feeds on *Cyamopsis* (cluster bean) and indigo in S. India.

The eggs are laid in incisions in the tender shoots. The same stem or shoot may be attacked several times, as this weevil is present in the field in all stages at all seasons of the year.

BAKER (A. C.). **The Correct Name for our Apple-Grain Aphis.**—*Science, Lancaster, Pa.,* xlvi, no. 1191, 26th October 1917, pp. 410–411.

The author is of opinion that more than one species occurs upon grains and grasses under the name of *Aphis avenae*, F. One of these migrates to apple and related trees, on which eggs are laid, this species being *A. prunifoliae*, Fitch. Another species, the oat aphis, migrates to bird cherries in Europe and must be known as *A. padi*, L., of which *A. avenae*, F., is a synonym. The species now known as *A. cerasifoliae*, Fitch, migrates to grains and grasses as does *A. padi*, and is possibly the same species. The present treatment of *A. prunifoliae* as a synonym of *A. cardui*, L., is incorrect.

BENEDICT (R. C.). **An Outline of the Life-History of the Clothes Moth,** ***Tineola bisselliella.***—*Science, Lancaster, Pa.*, xlvi, no. 1193, 9th November 1917, pp. 464–466.

Careful examination extending over a period of four years has led to the conclusion that the extensive damage which is done in connection with the fur and woollen trades in New York is due to *Tineola bisselliella*, while the case-forming clothes moth, *Tinea*, is of comparatively rare occurrence.

Adults emerge from cocoons in June and July, breeding taking place immediately after emergence and being followed by oviposition within 24 hours. Single females lay from 30 to 160 eggs, the average number being 40–50. The eggs are attached among the threads of cloth by some adhesive substance. On hatching the larvae immediately begin to spin a case or passage several times the length of the body, in which they live, a new one being made on a change of feeding place. Larval growth is completed in 10 weeks, the pupal stage lasting for 2 weeks, though all stages may be indefinitely prolonged by factors such as the failure of food-supply, and cold.

As regards remedies, those against the winged adults are worse than useless, and repellents such as tobacco and cedar oil are ineffective in any stage. The larval stage and the eggs can be killed by camphor and naphthaline in closed places, but kerosene and gasoline fumes are not effective, neither have experiments on poisoning the larvae by treating cloth and fur materials met with any success.

SMITH (H. E.). **Five New Species of North American Tachinidae.**—*Psyche, Boston, Mass.*, xxiv, no. 5, October 1917, pp. 137–141.

The new species described in this paper include *Homoeonychia rapae*, bred from *Pieris* (*Pontia*) *rapae*.

KING (H. H.). **The Pink Bollworm** (*Gelechia gossypiella*, **Saunders**) **in the Anglo-Egyptian Sudan, and Measures for its Control.**—*Entom. Bulls. nos. 4 & 5, Wellcome Trop. Research Labs., Khartoum*, 11th September 1917, 7 & 6 pp. [Received 1st December 1917.]

The presence of *Pectinophora* (*Gelechia*) *gossypiella*, Saunders (pink bollworm) was first detected in the Sudan in April 1916, since when it has been taken in several localities and may be considered to have established itself in the country, some districts being heavily infested. It probably entered the Sudan in seed imported from Egypt prior to 1913, in which year importation of cotton seed from that country was stopped.

The known food-plants of this pest in Egypt, besides cotton, are *Hibiscus esculentus*, *H. cannabinus* and *Althaea rosea* (hollyhock). In the Sudan it has been taken on *Abutilon* spp., which are favourite food-plants of several cotton pests, including *Earias insulana*, *Oxycarenus hyalinipennis* and *Nisotra uniformis* (cotton flea-beetle).

Legislation to check the spread of the pink bollworm and control it in districts where it is already established, provides for the following :—Prohibition of the importation into the Sudan of cotton seed and ginned or unginned cotton except under special permit ;

prohibition of the transport of cotton seed or unginned cotton from an infested to a non-infested district; destruction of all living forms of *P. gossypiella* in seed kept for sowing; prevention of the escape of moths of *P. gossypiella* emerging from seed in ginning factories and stores; destruction on the land on which it has been grown, by burning, of all cotton sticks, bolls and refuse generally, immediately after the last picking, as well as of all plants, whether cultivated or wild, that may act as hosts of *P. gossypiella*; establishment of a close season for cotton and other host-plants between the time of the burning of the cotton refuse, etc., and the sowing of the new crop. The object of the close season is to give rise to a period when there are no living plants on which *P. gossypiella* can feed. For this purpose, owing to the differences of the seasons in the various parts of the Sudan, the country is divided into districts and dates are fixed every year for each district by which all cotton stocks, etc., must be burnt and before which no cotton, etc., may be sown.

The simple and effective method of killing pink bollworm in cotton seed by heating it to a temperature of 50° C. for a short time can be effected in the Sudan by exposing it in a thin layer to the sun's rays on a moderately hot day, the vitality of the seed not being affected below a temperature of 70° C.

KING (H. H.). **The Sudan Cotton Bollworm** (*Diparopsis castanea*, **Hampson**).—*Entom. Bull. no. 6, Wellcome Trop. Research Labs., Khartoum*, 10th October 1917, 3 pp. [Received 1st December 1917.]

Diparopsis castanea, Hmps. (Sudan or red bollworm) occurs throughout Africa except in the extreme north and south.

When present in large numbers, this pest may do much damage, as, owing to its size, a single larva generally destroys several buds and bolls before attaining maturity. It is not usually so plentiful as *Earias insulana*, Bdv., and hitherto has not been found attacking any plant but cotton. Two control measures are recommended, hand-picking while the first bolls are forming, and the burning of all cotton sticks after the last picking, followed by the ploughing of the land to destroy the pupae; this operation should not be carried out on farms infested with *P. gossypiella* till a spell of hot weather has destroyed any pink bollworms contained in bolls lying on the ground.

ZAKI (M.). **Note on a Species of** *Ascalaphus*.—*Bull. Soc. Entom. d'Egypte, Cairo*, x, no. 1, January-March 1917, pp. 21–22. [Received 3rd December 1917.]

From egg-masses on cotton leaves examined by the Entomological Section of the Ministry of Agriculture, Ascalaphid larvae were hatched, and these were successfully reared on young larvae of the cotton worm, *Prodenia litura*, on which they fed voraciously. Attempts to rear them on flies, fruit-flies or pink bollworms [*Pectinophora gossypiella*] were unsuccessful. From this fact and the situation of the eggs, which were in rows on the under-surface of the leaves near the midrib, it would appear that the natural food of these insects consists of cotton worms and other Noctuid larvae. When fully fed, and after moulting

three times, the larvae spun cocoons in the corner of the breeding-cage, whence the adults emerged, the total life-cycle averaging 9 to 10 weeks.

Clainpanain (J.). **Notes sur certains Coléoptères xylophages d'Egypte et leur Abondance à certaines Epoques.** [Notes on certain Xylophagous Coleoptera of Egypt and their Abundance in certain Seasons.]—*Bull. Soc. Entom. Egypt, Cairo*, x, no. 2, April-June 1917, pp. 72-77. [Received 3rd December 1917.]

In this paper the author records several species of xylophagous beetles that increase with great rapidity in Egypt and Syria and do a good deal of damage before they can be controlled. An example of this is found in the Buprestid, *Ptosima undecimmaculata*, which is of recent introduction and hitherto considered rare in Egypt. In a neglected orchard at Matarieh several individuals were found in February on a flowering apricot-tree and two weeks later large numbers were attacking the same orchard, many of the young trees being killed by them. *Scolytus (Eccoptogaster) multistriatus* hastens the death of trees thus attacked. Another Buprestid, *Psiloptera catenulata*, attacked pomegranate-trees in the same orchard, these being further injured by the larvae of the Cossid, *Zeuzera pyrina*. The Cerambycid, *Macrotoma palmata*, has recently been increasing rapidly, the larvae being found in the trunks of dead and dying apricot-trees. Another species, *Xystrocera globosa*, which has caused the disappearance of *Acacia lebbek* from the streets of Cairo, would in all probability adapt itself to fresh host-plants if this tree disappeared completely from Egypt.

The control of wood-boring insects is difficult; in the case of a living tree, it is impossible to kill the larvae without causing the death of the tree, and even when a tree is destroyed, the insects continue to develop, although more slowly. In Syria, in the autumn of 1912, two or three individuals of a Bostrychid beetle, *Apate monacha*, were captured and in the following year a swarm occurred, resulting in a heavy infestation of Zinzelats. These insects when placed in an empty bottle were found to be cannibalistic. They attack for preference old or sickly trees; vigorous trees, as well as *Bauhinia variegata* and *Acacia atrox*, are defended from the attacks of these beetles by their gummy exudations.

It is suggested that imported trees that are incompletely acclimatised, or young and weakly trees are less able to offer resistance and are therefore selected by indigenous or imported wood-boring insects, which adapt themselves easily to new conditions of life and are not highly selective in their choice of food-plants. Indigenous trees are better able to resist attack; it took some 30 years for *Xystrocera* to threaten the existence of lebbek trees in Egypt; *Acacia nilotica* is still thriving in spite of numerous enemies, such as *Lasiocampa*, which devours the leaves, Buprestids, *Macrotoma* and *Cossus* larvae that devour the wood or live under the bark. A single tree that furnished the author 10 years ago with hundreds of larvae of *Cossus* is still living. As many new varieties of trees are being introduced into Egypt, it will be necessary to guard carefully against the introduction of new insect enemies, more particularly of those that experience has shown to be capable of adapting themselves to new conditions of life.

Gowdey (C. C.). **Report of the Entomologist.**—*Ann. Rept. Uganda Dept. Agric. for the Year ending 31st March 1917, Kampala,* 1917, pp. 32–37. [Received 3rd December 1917.]

A list of the scale-insects attacking coffee is given; these include:—*Icerya nigroareolata,* Newst., which is frequently found on crotons and occasionally attacks coffee; *Asterolecanium coffeae,* Newst.; *Pseudococcus citri,* Risso, which has previously been recorded [see this *Review,* Ser. A, v, p. 118]. The life-history as occurring in Uganda is given; the most usual injury is to the foliage and roots. Remedial measures should be directed against the young larvae, as these are unprotected by any waxy covering. *P. virgatus,* Ckll., attacks the foliage and green twigs. *Pulvinaria psidii,* Mask., is always accompanied by the sooty fungus, *Capnodium brasiliense,* which lives on the exudations of the insect. *Coccus viridis* is so highly parasitised by a small Chalcidid and preyed upon by Coccinellids, especially *Chilocorus discoideus,* that in several localities remedial measures are unnecessary. The caterpillars of the Limacodid, *Parasa* sp., were not abundant, the cocoons being parasitised by *Chrysis* (*Tetrachrysis*) *lyncea,* F., and *C. postscutellaris,* Mocs. *Agrotis* spp. (cutworms) were active on some estates, but no damage was reported. *Leucoptera* (*Cemiostoma*) *coffeella,* Staint., first appeared as a coffee pest in Uganda in July 1916, and is as yet confined to one district. The larvae mine the leaves until they appear scorched and eventually drop. The only control possible is the collection of infested leaves. *Stephanoderes coffeae,* Haged. (coffee berry borer), though still ubiquitous, has considerably decreased in numbers. Other stem-borers of coffee were *Nitocris princeps,* Jord., *Apate indistincta,* Murr., and *A. monacha,* F. The Aphid, *Toxoptera coffeae,* Nietn., frequently occurs on young coffee plants; the best treatment is 1 lb. whale-oil soap to 7 gallons of water. *Antestia lineaticollis,* Stål (*orbitalis* var. *faceta,* Germ.), as anticipated, has become a serious coffee pest; it is being investigated and will be more fully dealt with later. Another bug, *Lycidocoris mimeticus,* R. & P., has been found attacking young leaves, but nothing is yet known of its habits.

The pests of cacao were, for the most part, the same as those recorded in the previous report. They include the Aphid, *Toxoptera coffeae,* Nietn. (*theobromae,* Schout.), and the scale-insects, *Pseudococcus* sp. and *Inglisia castilloae* var. *theobromae.* The former scale attacks the pods and leaves and the latter the pods, flower-clusters and young twigs; both can be controlled by spraying with kerosene emulsion.

Tea is not largely grown in Uganda; the only insects as yet observed on this crop are *Aspidiotus transparens,* Green, on the leaves, *Coccus discrepans,* Green, on the roots, and *Helopeltis bergrothi,* Reut., var., on the young leaves and tender shoots.

On cotton, the stainers, *Dysdercus* spp. and *Oxycarenus* spp., were abundant, but *Earias insulana* (spiny bollworm) was less prevalent than in the previous year. The pink bollworm [*Pectinophora gossypiella*] has not yet been detected.

Rubber pests included the scales, *Aspidiotus destructor,* Sign., and *Icerya sulphurea,* Lind., not hitherto recorded from Uganda.

Fruit-tree pests included: on orange, *Trioza* sp. (citrus psylla); *Aphis citri,* Ashm.; *Papilio demodocus,* Esp.; *Ceratitis capitata,* Wied.;

the scales, *Lepidosaphes gloveri*, Pack.; *L. beckii*, Newm. (*citricola*, Pack.), and *Selenaspidus silvaticus*, Lind. On pineapple, *Pseudococcus bromeliae*, Bch. On mango, *Ceratitis punctata*, Wied.; *Icerya seychellarum*, Westw.; *Pseudaonidia trilobitiformis*, Green; and *Aspidiotus destructor*, Sign. On custard apple, *Antestia lineaticollis*, Stål; *Tachardia decorella*, Mask., and *T. longisetosa*, Newst. (lac-producing scales); *Stictococcus diversiseta*, Silv., *Ceroplastes quadrilineatus*, Newst., and *C. ceriferus*, And. On guava, *Icerya sulphurea*, Lind., *Tachardia decorella*, Mask., *Inglisia conchiformis*, Newst., *Ceroplastes singularis*, Newst., *Coccus setigerum*, Newst., *C. signatum*, Newst., *Aspidiotus cydoniae*, Comst., and *A. destructor*, Sign. On banana, *Aspidiotus cyanophylli*, Sign., and *A. destructor*.

The shade tree, *Gliricidia maculata*, is attacked by the scales, *Pseudococcus citri* and *Coccus longulus*, Dougl., and by the Aphid, *Toxoptera coffeae*, Nietn.

Six swarms of locusts were reported during the year.

Parasites and predaceous insects were studied and reared in large numbers; these include: *Coccophagus nigropleurum*, Gir., and *Aenasiella africa*, Gir., reared from *Tachardia decorella*, Mask., and a moth larva *Stathmopoda oesteëtis*, Meyr., predaceous on this scale; *Tetrastichus gowdeyi*, Crawf., reared from *Pulvinaria jacksoni*, Newst.; *Neomphaloidella ceroplastae*, Gir., *Eurytoma galeati*, Gir., and *Scutellista cyanea*, Mots., reared from *Ceroplastes galeatus*, Newst. *Eublemma scitula*, Ramb., was found to be predaceous upon *Inglisia conchiformis*, Newst. *Coccophagus saintbeauvei*, Gir., was bred from *Saissetia oleae*, Bern.; caterpillars of *Eublemma costimacula*, Saalm., were found preying upon *Stictococcus diversiseta*, Silv. *Coccophagus comperei*, Gir., and *Epitetrastichus ugandensis*, Gir., were reared from *Stictococcus gowdeyi*, Newst. *Chilocorus discoideus* was predaceous upon *Aspidiotus destructor*, Sign., and *Epilachna punctipennis*, Muls., upon *Aphis gossypii*, Glover. *Tetrastichus ovivorum*, Crawf., was reared from *Conchyloctaenia punctata*, F., and *T. sculpturatus*, Waterst., from *Neptis agatha*, Cram. *Phorinia verritus*, Walk., was reared from *Dasychira crenulata*, B.-B.; and a new species of *Bothria*, *Cryptus formosus*, Brullé, *Apanteles africanus*, Vier., and *Telenomus gowdeyi*, Crawf., from *Anaphe infracta*, Wlsm.

De Seabra (A. F.). **Études sur les Maladies et les Parasites du Cacaoyer et d'autres Plantes cultivées à S. Thomé.** [Studies on the Diseases and Parasites of the Cacao-tree and other Plants cultivated at S. Thomé.]—*Mémoires Soc. Portugaise des Sciences Naturelles, Lisbon*, iii, no. 1, 10th January 1917, 28 pp. 24 figs., 1 plate.

The pests dealt with in this paper include the Coccids, *Aspidiotus trilobitiformis*, Green, on cacao; *Coccus* (*Lecanium*) *viridis*, Green, on coffee, on which it is infested by the fungus, *Cephalosporium lecanii*; *Selenaspidus* (*Aspidiotus*) *articulatus* and *A. palmae*, on coffee, *Ficus* sp., *Castilloa*, and *Carica papaya*; *Saissetia* (*Lecanium*) *nigra* on *Ficus* sp.; *Orthezia insignis*, on coffee and other plants; and several termites damaging cacao, including *Neotermes gestroi*, and *Microcerotermes parvus theobromae*.

Weiss (H. B.). **Popular and Practical Entomology. Graphic Presentations of Entomological Facts.**—*Canadian Entomologist, London, Ont.*, xlix, no. 11, November 1917, pp. 365–371.

The author points out the desirability of presenting entomological facts in a graphic and easily assimilated manner; in particular he advocates the use of graphs to replace tables of figures, or to illustrate the text. Several examples of suitable charts, graphs and maps are given.

Ferris (G. F.). **A New Genus and Species of Coccidae. (Hemip.; Homop.)**—*Canadian Entomologist, London, Ont.*, xlix, no. 11, November 1917, pp. 375–378, 4 figs.

The new genus, *Stomacoccus*, is erected in this paper, the type, *S. platani*, sp. n., having been taken on the leaves, branches and trunk of *Platanus racemosa* (sycamore) in California. The insect apparently hibernates on the bark and then crawls to the leaves. The life-cycle is probably quite short, all stages having been found on leaves scarcely a month old.

Whetzel (H. H.). **Dusting as a Substitute for Spraying: History and Progress.**—*48th Ann. Rept. Fruit Growers' Assoc. Ontario, 1916; Toronto*, 1917, pp. 37–47. [Received 3rd December 1917.]

There have been two periods in the history of dusting as a substitute for spraying for the control of apple disease in North America. The first extended from about 1900 to 1908 at a time when Bordeaux and Paris green were the standard fungicide and insecticide respectively, the dust mixtures tested being of the same nature. The most extensive tests were made in Illinois, with such decisively unsatisfactory results that dusting was entirely abandoned by experiment stations. It should be noted that this failure was due to the use of a fungicide and insecticide unsuitable for application in a dry form, and that the machinery used was primitive and not well adapted for orchard work. Since 1909, lime-sulphur and arsenate of lead have largely replaced Bordeaux and Paris green for the spraying of apples, the change being marked by a distinct advance in disease and insect-pest control. In 1911 another step in the progress of disease control was made by the substitution of dusting for spraying; the advantages are greater rapidity in making applications, there being seldom more than 1-4 days in which a given application may profitably be made, and the use of an outfit that eliminates heavy machinery and tons of water, at a time when the ground in orchards is soft and heavy. Experiments made in 1916 to test the relative values of spraying and dusting, resulted in favour of the former, owing to inexperience and the use of coarse sulphur and imperfect machinery in a season exceptionally favourable to scab. It is expected that with increasing experience, improved dusters and finer sulphur, better results will be secured with dusting than with spraying.

As regards the relative cost of the two methods, hitherto that of dusting has been rather higher, owing to the coarseness of the sulphur used, which has made it difficult to cover the trees thoroughly, but with finely ground sulphur and improved dusting machinery, there should be little, if any, difference in cost.

CAESAR (L.). **Dusting for Tender Fruits and Apples.**—*48th Ann. Rept. Fruit Growers' Assoc. Ontario, 1916; Toronto,* 1917, pp. 47–51. [Received 3rd December 1917.]

Experiments with dusting were carried out in an apple orchard of 162 large trees, 92 being selected for dusting, 51 for spraying with liquid lime-sulphur and lead arsenate, and the remainder for spraying with soluble sulphur and calcium arsenate. The whole orchard was first heavily sprayed with lime-sulphur to control San José scale [*Aspidiotus perniciosus*], which was somewhat abundant, and the selected trees were then dusted twice with a mixture of 85 per cent. finely ground sulphur and 15 per cent. arsenate of lead, the first application being given just as the blossoms were ready to burst, and the second very soon after they had fallen; 3 lb. of the mixture was sufficient for each tree. The trees receiving liquid sprays were treated with equal care and at the same times, to ensure a fair comparison. The results showed that the foliage on the dusted area was decidedly superior to that which had been sprayed, while there was very little difference in the degree of control of the codling moth [*Cydia pomonella*] and the lesser apple worm [*Enarmonia prunivora*], the lime-sulphur and lead arsenate perhaps giving the better result, as it also did in the case of apple scab.

Plums dusted against brown rot showed a decided benefit as compared with untreated trees.

The most important point in the treatment of sweet cherries was that those treated with a liquid spray still showed evident traces of it at picking time, while those dusted, even only two or three days before picking, showed none. In a dust spray applied so late, the poison would naturally have to be omitted and only the sulphur used.

Peaches were found to hold the dust for several weeks after application, hence in bad years the method should afford ample protection. Although the year was not a good one for testing purposes, it was evident that dusting was of considerable value in the control of powdery mildew on grapes.

The comparative cost of dust spraying varies with the size of the tree, being slightly cheaper than liquid spraying for large trees, 50 per cent. dearer for medium trees, and more expensive still for small trees. In all cases the time required for dusting was much less than that occupied in liquid spraying, varying from $\frac{1}{8}$ for large trees to $\frac{1}{2}$ for small ones. On the other hand the liquid spray held on the leaves much better than the dust, and though in the long run the dust method will probably prove satisfactory, caution must be exercised in the purchase of dusting machines at the present time.

CAESAR (L.). **Insects attacking Fruit Trees.**—*Ontario Dept. Agric., Toronto,* Bull. 250, July 1917, 49 pp. 58 figs. [Received 3rd December 1917.]

This popular and comprehensive bulletin deals with all the well-known insects attacking fruit trees in Ontario, giving the methods of control for each and directions for spraying by both wet and dry methods. A spray calendar and index are appended.

Reports on the State of the Crops in each Province of Spain.—*Bol. Agric. Técnica y Económica, Madrid*, ix, 1917, pp. 71–92; 163–185; 251–277; 354–375; 711–733; 809–824; 916–965. [Received 4th December 1917.]

Locust control in the Province of Madrid was begun in the month of January, the Ministry of Agriculture inaugurating a vigorous campaign for the destruction of the eggs in infested areas, and calling upon all local committees and persons interested to carry out the necessary measures of ploughing and cleansing the land in order to avoid the necessity for costly and less efficacious methods of control against the hoppers in the spring. This campaign continued until April, 2,177 acres being found infested, of which 1,315 acres were treated. In Cuenca, an official notice published in August appealed to the local authorities to report upon any localities where locusts had hatched, so that these areas could be treated in the following winter.

Phloeothrips oleae caused considerable injury in various olive-growing provinces, this pest being the principal factor in determining the value of the olive crop. Fumigation with hydrocyanic acid gas has been almost universally practised under the inspection of the Ministry of Agriculture, those trees which it was impossible to treat in this manner being sprayed in April with arsenate of lead. The crop in some provinces has proved to be the most abundant that has been known.

For Aphids on almonds, which began to appear in April, a spray of 1½ per cent. each of soap and petroleum is recommended.

Vine pests included *Clysia ambiguella*, *Haltica* and *Sparganothis pilleriana*, which last was found heavily infesting some districts in May, while the second generation of *C. ambiguella* was particularly numerous in some localities. *Colaspidema* sp., which threatened to be a serious pest of lucerne fields in Gerona [see this *Review*, Ser. A, v, p. 373], was exterminated before the end of June. Apples in Vizcaya were severely attacked by *Eriosoma lanigerum* and *Hyponomeuta malinellus*. *Lymantria* (*Liparis*) *dispar* caused great damage in Cáceres, and *Pieris brassicae* was a serious pest of green vegetables in Huesca.

Artigas (C. M.). **Sobre los Azufres precipitados (negros).** [A Note on Precipitated (Black) Sulphur.]—*Bol. Agric. Técnica y Económica, Madrid*, ix, no. 100, April 1917, pp. 326–328.

Precipitated sulphur is recommended where arsenates have not been used as an insecticide against the larvae of *Haltica* and other insects that live on the surface of the leaves, besides being a control for *Oidium*.

Comes (H.). **La Profilaxia en Patología vegetál.** [Prophylaxis in Vegetable Pathology.]—*Bol. Agric. Técnica y Económica, Madrid*, ix, no. 102, June 1917, pp. 508–514.

As the quantity of sugar, so much sought after by insects, increases in vegetable tissues, there is a corresponding diminution in the organic acids; it follows therefore that the acidity is the plant's defence against animal enemies. Of these acids, the most toxic is apparently

malic acid. Thus the young branches of white mulberry are defended by their acidity from *Aulacaspis* (*Diaspis*) *pentagona*; young citrus trees from *Pseudococcus citri* and *Chrysomphalus dictyospermi*; young fig-trees from *Ceroplastes rusci*; young olives from *Saissetia oleae* and *Filippia* (*Philippia*) *oleae*; citrus and other fruit-trees from caterpillars; olives from *Dacus oleae*; grapes from *Cryptoblabes gnidiella* (*Albinia wokiana*) and the vines from *Phylloxera*.

FAUCHÈRE (—). **La Sériciculture à Madagascar.** [Silkworm Culture in Madagascar.]—*C. R. Hebdom. Acad. Sciences, Paris*, clxv, no. 20, 12th November 1917, pp. 676–677.

The varieties of *Bombyx* (*Sericaria*) *mori* introduced into Madagascar from south Europe were all monovoltine, producing one generation a year, but on becoming acclimatised at the end of about two years they produced six generations. So far from their silk being inferior in quality and quantity to that of the monovoltine forms, it proved to be of first rate quality. Again, while the eggs of the original species would hatch only after hibernation, those of the polyvoltine forms hatched regularly 12 or 13 days after being laid.

As in Europe, silkworms in Madagascar are attacked by several diseases, especially pebrine, rendered more serious in the tropics by the continuous breeding of the insects throughout the year and the carelessness of their native cultivators.

In order to obtain strains of non-infected eggs an improved form of the cellular egg-tray used in Europe was employed, thus preventing the usual mixing of the eggs, so fatal in ordinary practice.

GRASSI (B.) & TOPI (M.). **The Number of Races of Vine Phylloxera.**—*Mthly. Bull. Agric. Intell. & Pl. Dis., Rome*, viii, no. 9, September 1917, pp. 1322–1327. [Abstract from *Rendiconti Sedute R. Accad. Lincei, Classe di Scienze fisiche, matematiche e naturali, Rome*, 5th Ser., 1st half-year 1917, xxvi, no. 5, pp. 265–273.] [Received 10th December 1917.]

The authors of this paper, desiring to solve the problem of the different ways in which *Phylloxera* spreads in Italy, undertook investigations on a gall-producing form that had developed on leaves of the Clinton variety of vine at Arizzano. The results showed that with galls taken from that variety it was not possible to infect either the leaves or roots of the various American vines, though these can be infected with galls and nodules from material taken from other vines in other districts. Galls are apparently most easily produced on varieties identical with or similar to those already infected. The authors suggest as a likely hypothesis that, in order to continue the cycle to the winter egg, the winged insects oviposit on the leaves or bark of vines near those on the roots of which they have developed, and that the passage of the gallicolae from one vine to another, and consequently the formation of galls, is regulated by conditions hitherto unknown. This hypothesis was confirmed in another series of tests and observations. The winged form, which contributes to the dispersal of the insect, develops comparatively rapidly on the roots of European vines, while the gall-producing form does

not generally appear on Italian vines. The question therefore arises as to the fate of the insects which, particularly in the infected vineyards of Upper Italy, are produced in such great abundance. Do the gallicolae, on leaving the winter egg and finding no vine suited to the production of galls, disappear and die, or do they disperse before laying eggs, or lay them promiscuously, so that the sexual insects only meet with difficulty ? As an experiment in this connection two plants in a vineyard, one a Cliuton and the other an Italian vine, were covered over with a cage and many nymphs from infected vines as well as winged forms were placed in them. In the following spring, contrary to expectation, no galls had formed on either of the covered trees. It is difficult to account for this absence of gallicola infection. Apparently the Clinton variety, which is of uncertain origin, is incapable of bearing galls and therefore on this plant the gallicolae that hatch from the winter eggs are lost. It might also be assumed that to produce the infection it is necessary not only that the plant should be capable of producing galls, but that infection should first occur in the roots, or that galls either from the same vine or from specified vines should be used. This hypothesis would explain the experiments already described and is supported by the fact that in the same vineyard, which had been almost totally destroyed by *Phylloxera*, there was no sign of infection in the different varieties of wild American vines present in it. If the American vines or the hybrids had had any attraction for the winged insects, infection must have occurred.

It is known that gallicola infection always appears in a country or district after, even many years after, radicola infection. This may possibly be explained by admitting the necessity for the passage of infection through the roots of American vines. If these vines attract winged insects of any origin, it would not be difficult to explain the absence of galls in vineyards of stock plants of American vines bordering on phylloxera-infected belts, as occurs in so many nurseries in Apulia.

THEOBALD (F. V.). **Poultry in Orchards and Their Effect on Injurious Insects.**—Reprint from *Fruit, Flower & Vegetable Trades' Journal, London,* 13th October 1917, 2 pp.

Fowls are of far more practical use than is generally supposed in checking insect pests of fruit, and the trees both in grass-grown and cultivated orchards where they are allowed to run are much healthier for their presence. In spring and summer they destroy the caterpillars of *Cheimatobia brumata* (winter moth) that come down to pupate in June, as well as those that have been blown or washed off the trees; they also pick up the wingless females emerging from the ground in autumn and winter and so stop the next year's attack. Larvae of *Cydia pomonella* (codling moth) are eagerly devoured, as also are those of *Eriocampoides* (*Eriocampa*) *limacina* (pear and cherry sawfly), *Chloroclystis* (*Eupithecia*) *rectangulata* and many of the leaf-rolling Tortricids, while *Malacosoma* (*Clisiocampa*) *neustria* (lackey moth) is occasionally taken. *Contarinia* (*Diplosis*) *pyrivora* (pear midge) is said to be controllable only by fowls kept under the trees through June and into July. The cocoons of ants, particularly of *Myrmica* and *Lasius*, are a favourite food, and thus *Aphis malifoliae*, which is

attended and protected by the ants, is also in a large measure controlled. Many Aphids have been found in dissecting the crops of young fowls, including *Aphis malifoliae* (blue aphis), *A. pomi* (green apple aphis), *A. grossulariae* (gooseberry aphis), *Myzus ribis* and *Rhopalosiphum lactucae* (currant Aphids), *A. pruni* (plum aphis), *Hyalopterus arundinis* (*pruni*) (mealy plum aphis), *Amphorophora rubi* and *Macrosiphum rubiellum*. In cultivated land wireworms, surface larvae and leather jackets are cleared off, and weevils, including *Anthonomus pomorum* (apple blossom weevil) and *Otiorrhynchus picipes* (raspberry weevil) are searched for and devoured.

Examples are given of analyses of the crop contents of four birds, illustrating the variety and quantity of insect food eaten by old and young birds. Care should be taken in the choice of breed suitable for orchard or plantation; lighter breeds are more active in hunting out insects, but unfortunately they frequently attack fruit when almost ripe and are able to fly to some height to reach it; while still young, they may be allowed free access to the orchard, and at any age until the fruit is half-grown, while among standard trees they may be kept permanently.

ADKIN (R.). **Apples attacked by the Larvae of *Porthesia similis* (*auriflua*).**—*The Entomologist, London*, l, no. 655, December 1917, p. 279.

At the end of September, in Sussex, apples growing near the tip of a branch were found denuded of a large portion of their skin, about a score of young larvae of *Arctornis chrysorrhoea* (*Porthesia similis*), being found feeding on them. As there was plenty of foliage on the tree, this attack on the fruit was made from choice and not of necessity.

BOVELL (J. R.) & D'ALBUQUERQUE (J. P.). **Report on the Sugar-Cane Experiments for the Season 1915-1917.**—*Dept. Agric. Barbados*, 1917, 79 pp., 56 tables.

The results of experiments with different varieties of sugar-cane and with manures for them could not be regarded as conclusive owing to the presence of a disturbing factor in the form of the larvae of *Diaprepes abbreviatus*, L. (root borer), and *Phytalus smithi*, Arrow (brown hard-back), which attacked the canes in the experimental plots to such an extent as to render it impossible to draw any definite conclusions from the investigations.

The monetary loss sustained from the attacks of these pests is considerable and may involve a loss of 7 tons of cane or about £9 12*s.* per acre. That these pests are increasing is proved by the fact that although 8,122 of their larvae were destroyed on the experimental plots in 1915, in 1917 the same plots yielded 8,227 larvae.

In Porto Rico, where great loss is being sustained from the attacks of the larvae of certain brown hard-back beetles very similar to those in Barbados, the cost of hand-picking in one small district for two years is estimated at about £1,230, and even then the beetle is not held in check, but continues to increase.

GREEN (E. E.). **Observations on British Coccidae; with Descriptions of New Species, No. III & No. IV.**—*Entomologists' Mthly. Mag., London*, liii, nos. 640, 642, 643, September, November, December 1917, pp. 201–210, & pp. 260–269.

These notes are in continuation of two previous papers [see this *Review*, Ser. A, iv, p. 123, and iii, p. 753]. The species recorded are—*Eulecanium (Lecanium) bituberculatum*, Targ., occurring abundantly on hawthorn; *L. capreae*, L., taken upon *Myrica gale* and upon evergreen laurel, both of these constituting new food-plants for this species; *Saissetia (L.) nigra* var. *depressa*, Targ., in the palm-house at Kew, on *Musa* and *Ficus* sp.; *Eulecanium (L.) persicae crudum*, subsp. n., on the foliage of *Aralia*; *Coccus (L.) hesperidum*, L., var., flourishing on an orange plant raised from seed in the botanical laboratory, Manchester; *L. signiferum*, Green, on *Polypodium aureum* at Kew; *L. zebrinum*, sp. n., on the branches and young stems of *Betula alba* (birch) and *Populus tremula* (aspen), the female being extensively parasitised by two species of Chalcids; *L. transvittatum*, sp. n., an extremely scarce species found on *Betula alba* (birch); *Lecanopsis longicornis*, Green, found in comparative abundance on *Carex ovalis*; *Parafairmairia gracilis*, Green, affecting various species of *Carex*; *Eriopeltis festucae*, Fonsc., on the upper surface of the leaves of *Festuca*; *Luzulaspis luzulae*, Duf., on *Carex ovalis* and *Luzula*; *Ceroplastes rusci*, L., on the fruit of green figs imported from Italy; *Physokermes abietis*, Geoffr., on spruces; *Gossyparia ulmi*, Geoffr., on Cornish elm; *Eriococcus devoniensis*, Green, on *Erica tetralix*; *Ripersia halophila*, Hardy, on roots of grasses; *Pseudococcus nipae*, Mask., abundant in the palm-house at Kew upon *Cocos*, *Kentiopsis* and *Sabal*, where it has probably been established for some years; *P. walkeri*, Newst.; *P. longispinus*, Targ., on imported bananas; *P. longispinus* var. *latipes*, nov., on *Fuchsia* in a green-house and in cactus-houses at Manchester; *P. newsteadi*, sp. n., on *Fagus sylvatica* (beech) at Camberley, the young larvae migrating in December to the ends of the branches where they hibernate beneath the scales of the leaf-buds, the return migration to the larger branches taking place in June; *Aspidiotus lataniae*, Sign., taken on *Dracaena*, under glass; *Lepidosaphes gloveri*, Pack., on *Nephrodium* sp., under glass at Kew and also often found on the rind of imported oranges; *Kuwania gorodetski*, Nassonov, reported from Camberley in 1914, and reappearing in abundance in 1917, its apparent disappearance meantime, possibly being due to an unusually prolonged nymphal period.

LOCHHEAD (W.). **Masterpieces of American Economic Entomology.**—*Ninth Ann. Rept. Quebec Soc. Protection Plants from Insects & Fungous Dis., 1916–1917; Quebec*, 1917, pp. 12–18. [Received 12th December 1917.]

This paper, which formed the President's address, reviews a few of the publications of special merit by economic entomologists of America. In commenting upon the absence of any Canadian works among these, the author remarks that Canada has been tardy in her

recognition of the importance of economic entomology, but much useful work is now being done and it is hoped that valuable additions will soon be made to the existing literature on this subject.

Chapais (J. C.). **A few Notes on the Pear Tree Slug.**—*Ninth Ann. Rept. Quebec Soc. Protection Plants from Insects & Fungous Dis., 1916–1917; Quebec,* 1917, pp. 25–27. [Received 12th December 1917.]

The larvae of *Eriocampoides limacina* (*Selandria cerasi*) (pear tree slug) causes much injury to pear, plum, cherry and quince trees in the orchards of Quebec, and to hawthorn, mountain-ash, and sallow in the woods. During 23 years' investigations only one brood has been observed in Quebec, the larvae first appearing at the beginning of August. To destroy them it is advisable to dust freshly slaked lime on the leaves of infested trees. Arsenical insecticides are recommended on cherry trees after gathering the fruit. In the case of a bad attack, where no insecticide has been used, ground fertilisers such as 125 lb. nitrate of soda, 200 lb. superphosphate and 40 bushels wood ash per acre are necessary to help the trees to recuperate.

Petch (C. E.). **Carriers and Diluents for Dusting.**—*Ninth Ann. Rept. Quebec Soc. Protection Plants from Insects & Fungous Dis., 1916–1917; Quebec,* 1917, pp. 28–29. [Received 12th December 1917.]

The value of dust as compared with liquid insecticides has been much discussed and tested during recent years. The dusting method has been much more extensively used during the season under review and has given good results, though there are still many objections to this method. It is not yet known whether sucking insects such as Aphids can be destroyed by dusting, though this method is successful for biting insects. One serious objection to dusting is its cost, and this consideration has led the author to make a study of carriers and diluents. Carriers should be nearly of the same specific gravity as the insecticide used, otherwise the heavier material will sink to the bottom of the container. A table is given showing the method of preparation, cost and efficacy of many carriers that growers can make for themselves; the best diluents and carriers as yet tried are talc schist, limestone, gypsum, china clay and silt.

Gibson (A.). **Cabbage Insects.**—*Ninth Ann. Rept. Quebec Soc. Protection Plants from Insects & Fungous Dis., 1916–1917; Quebec,* 1917, pp. 30–41, 2 plates, 2 figs. [Received 12th December 1917.]

This paper assembles a quantity of information, for the use of growers of cabbages, concerning the insects that attack these crops almost every year in Quebec. The species dealt with include *Chortophila* (*Phorbia*) *brassicae*, Bch. (cabbage root maggot); cutworms such as *Euxoa ochrogaster*, Gn., (red-backed), *E. messoria*, Harr. (dark-sided), *Agrotis ypsilon*, Rott. (greasy), and *E. tessellata*, Harr. (striped); flea-beetles such as *Phyllotreta vittata*, F. (turnip flea-beetle), and *Epitrix cucumeris*, Harris (potato flea-beetle); *Pieris rapae*, L.

(cabbage butterfly); *Plutella maculipennis*, Curt. (diamond-back moth); *Ceramica picta*, Harr. (zebra caterpillar); *Aphis brassicae*, L. (cabbage aphis); *Thrips tabaci*, Lind. (onion thrips); *Phytometra* (*Autographa*) *brassicae*, Riley; *Evergestis straminalis*, Hbn. (purple-backed cabbage worm); and blister beetles, such as *Epicauta pennsylvanica*, De G. (black blister beetle), *E. cinerea*, Forst. (grey blister beetle), and *Macrobasis unicolor*, Kirby (ash-grey blister beetle).

The locusts occurring in the Province include *Melanoplus atlantis*, Riley (lesser migratory), *M. femur-rubrum*, De G. (red-legged), *Camnula pellucida*, Scudd. (pellucid), and *Melanoplus bivittatus*, Say (two-striped).

The usual controls are given for these pests and several formulae for insecticides are included.

LEOPOLD (—). **What Insecticides and Fungicides shall we use in 1917, and when shall we spray this Year?**—*Ninth Ann. Rept. Quebec Soc. Protection Plants from Insects & Fungous Dis., 1916–1917*; *Quebec*, 1917, pp. 42–44. [Received 12th December 1917.]

Various spraying mixtures have been adopted in turn, as each was found more efficacious than the last. Arsenate of lead paste, which has long been in favour, is now being replaced in many cases by the powder, and the author questions whether a cheaper and just as effective insecticide as arsenate of lead could not be found. He is convinced also that the dormant spray for apple scab can be omitted without loss to the crop. Arsenate of lime is suggested as a possible substitute for arsenate of lead in all lime and sulphur sprays and with Bordeaux mixture; the arsenic in the former substance costing less than 55 per cent. of what it does when in the form of arsenate of lead. Arsenate of lime is known to do less damage than arsenate of lead with an equal strength of lime-sulphur. When arsenate of lead is added to lime-sulphur solution, a chemical change takes place, resulting in the formation of lead sulphide and three kinds of arsenate of lime, one of which, the mono-calcic-arsenate, is highly soluble and causes a large part of the scorching that results from the use of lead arsenate and lime-sulphur together, while nearly all the lead goes to the bottom of the tank as lead sulphide. When arsenate of lime is added to lime-sulphur, no chemical change takes place and so no soluble arsenic is formed. Arsenate of lime is therefore safer than arsenate of lead with a lime-sulphur spray, but it should never be used alone. Arsenate of lead on the other hand may safely be used alone.

The efficacy of Bordeaux mixture in preventing the falling of apples from the tree is questioned; and the results of experiments to determine at what period the lime and sulphur cause most scorching and dropping of the apples show that the greatest damage occurs two weeks or more after the blossoms, while Bordeaux mixture, used two weeks after the blossoms, is harmless as regards falling of the fruit. In suggesting a new scheme of spraying, which has been made as economical as possible, the author quotes Sander's work and gives substantially the same recommendations as those already published [see this *Review*, Ser. A, v, p. 230].

SWAINE (J. M.). **The White Pine Weevil, *Pissodes strobi*, in Quebec.**—*Ninth Ann. Rept. Quebec Soc. Protection Plants from Insects & Fungous Dis., 1916–1917*; *Quebec*, 1917, pp. 60–64, 2 plates. [Received 12th December 1917.]

Pissodes strobi (white pine weevil) is probably the chief cause of distorted and crooked white pine in Eastern Canada, the larvae killing the terminal shoots of young trees. For the last five or six years this weevil has been particularly abundant in Quebec and Ontario. The adults emerge from their winter quarters about April and oviposit upon the terminal shoots; the eggs hatch in about a week, and the young larvae work down the bark and, when mature, bore into the wood, penetrating to the pith. Cocoons are constructed in the ends of the tunnels, whence the weevils emerge during July and August and hibernate until the following spring. The best method of checking the injury is thorough collection of the fading tops in late June and again about the middle of July; these should be burned or else stored in boxes covered at the ends with fine wire netting in order to retain the beetles while allowing beneficial parasites to escape. When the adults appear in April, they may be collected by shaking into a net or a pan of kerosene. This should be done once a week in nurseries and plantations during the oviposition period, and on very valuable trees in parks and private grounds the collections should be made almost daily.

HUTCHINGS (C. B.). **Two Destructive Shade Tree Borers.**—*Ninth Ann. Rept. Quebec Soc. Protection Plants from Insects & Fungous Dis., 1916–1917*; *Quebec*, 1917, pp. 65–70, 1 plate. [Received 12th December 1917.]

Of the two borers discussed in this paper, *Cyllene robiniae* (the borer of the black locust tree, *Robinia pseudacacia*), which has been causing serious injury throughout Ontario and Quebec, has been dealt with previously [see this *Review*, Ser. A, v, pp. 398 and 551].

The Buprestid, *Agrilus anxius*, Gory, is the most destructive enemy of bronze birch in Quebec, where varieties of birch are cultivated extensively in parks and gardens. The insects begin to do damage at the top of the tree and work downwards, killing the upper branches first and then attacking the trunk and larger branches, through which the larval tunnels run, intersecting one another within the inner bark and sapwood. The eggs are laid on the bark in June, and the young larvae at once form their tunnels, in which they remain quiescent during the winter, continuing their burrows in the following spring. The only method that can be safely recommended is to cut out all infested branches and burn them, preferably at once or at least before May of the following year. Parasites undoubtedly form a very important factor in the natural control of this beetle, and the presence of birds should be encouraged in parks and gardens, as they certainly help in checking its numbers.

LOCHHEAD (W.). **Near Relatives of Insects Injurious to Plants and Animals.**—*Ninth Ann. Rept. Quebec Soc. Protection Plants from Insects & Fungous Dis., 1916–1917*; *Quebec*, 1917, pp. 138–144.

This paper gives a brief résumé of various pests of plants, including

wood-lice and red spiders in greenhouses, the clover mite (*Bryobia pratensis*, Gar.), the pear-leaf blister mite (*Eriophyes pyri*, Pgst.), millipedes, slugs and eelworms.

CORCORAN (J. A.). **The Commoner Grass-moths of Quebec.**—*Ninth Ann. Rept. Quebec Soc. Protection Plants from Insects & Fungous Dis., 1916–1917*; *Quebec*, 1917, pp. 71–77. [Received 12th December 1917.]

Crambid moths are abundant in the pastures and meadows of Quebec during June, July and August, particularly in the lower, moist meadows. They generally fly at dusk or when the weather is cloudy, resting during the daytime on the stalks of dried grass which they very closely resemble. Comparatively few Canadian species are of economic importance, though under favourable climatic conditions they may cause an almost total loss of the hay crop, and isolated infestations of *Crambus vulcivagellus* and *C. trisectus* in the United States have been as bad as invasions of the army worm [*Cirphis unipuncta*]. When wild grasses and sedges are plentiful the caterpillars do not attack grain, though *C. zeellus* and *C. caliginosellus* have been reported as pests of maize in Illinois and *C. hortuellus* as damaging cranberry runners in New England marshes. Eggs are dropped by the females at random among grasses and hatch in from 5 to 30 days. The larva spins a web on a blade of grass or in the axil between the blades and makes this its place of retreat, hiding there in the day and feeding at dusk; later, this web is exchanged for a more elaborate nest in which the caterpillar is well protected from enemies. As winter approaches, the larva extends the summer nest a short distance beneath the surface and there hibernates, *C. leachellus* disappearing early in August, *C. trisectus* in October and most of the other species in September. With the resumption of plant growth in the spring, the larva again becomes active and feeds voraciously until pupation takes place. The Crambids are very prolific, but as the injury is distributed throughout the growing season and the various species are most destructive at different times, the damage is very difficult to estimate. *C. agitatellus*, *C. alboclarellus*, *C. hortuellus*, *C. mutabilis* and *C. ruricolellus* are apparently the most abundant species in Quebec.

Many preventive measures have been suggested. Torches and trap-lanterns have not proved very successful; deep ploughing and a change to a root-crop should lessen the numbers in fields where the pest is established. Burning the dried grass in late autumn or early spring destroys those larvae that hibernate above ground, but these are few. Natural enemies, including an Ichneumonid, a Tachinid and a Chalcid, destroy great numbers, and birds and beetles even more, but climatic changes are the best check to the increase of these pests.

A key to the Crambids of Quebec is given.

DU PORTE (E. M.). **The Eye-spotted Bud-Moth** (*Eucosma* (*Spilonota*) *ocellana*, **Schiff.**).—*Ninth Ann. Rept. Quebec Soc. Protection Plants from Insects & Fungous Dis., 1916–1917*; *Quebec*, 1917, pp. 118–137, 17 figs.

This paper is the record of studies of *Eucosma ocellana* (eye-spotted bud-moth) conducted in Quebec, chiefly on the Island of Montreal, during the seasons 1914–1916.

Predators of the larvae of this moth include several species of birds, a wasp, *Odynerus catskillensis*, an unidentified Carabid beetle, a species of *Triphleps* and a mite, *Ancystis agilis*, Banks. Hymenopterous parasites include:—*Pimpla* (*Itoplectis*) *conquisitor*, Say, *Microdus* (*Bassus*) *earinoides*, Cress., and *Trichogramma* (*Pentarthron*) *minutum*, Riley, the last-named not having been previously recorded as a parasite of the egg of the bud-moth.

Where the usual spray calendar is followed, there should be little difficulty in keeping this insect in check, as is shown by the results of experiments given in this paper. The advisability of applying a summer spray depends upon the conditions; in a severe attack, when the spring spray has failed to control this pest, the application of this spray at the end of June is strongly advised. When a spray is being used for apple scab at this time, the addition of lead arsenate to the spray is recommended in order to control this moth. Dormant sprays have been tried against the hibernating larvae in February and March, but were not successful.

MOORE (W.). **Studies in Greenhouse Fumigation with Hydrocyanic Acid. I. Temperature and Moisture as Factors Influencing the Injury of Plants during Fumigation.**—*16th Rept. Minnesota State Entomologist for 1915–1916, St. Anthony Park*, 1st December 1916. pp. 93–108, 5 figs.

MOORE (W.) & WILLAMAN (J. J.). **II. Physiological Effects on the Plant.**—*Jl. Agric. Research, Washington, D.C.*, xi, no. 7, 12th November, 1917, pp. 319–338, 2 plates, 11 figs.

During the process of fumigation hydrocyanic acid gas penetrates the tissues of the plant either through the stomata or directly through the cuticle, the amount of gas passing through the cuticle being dependent on its thickness. Moisture on the leaves aids the gas to penetrate, but is not a very important factor when the plants have thick cuticles. High humidity aids penetration and after fumigation tends to prevent evaporation of the acid in the cuticle; low temperature during and after fumigation has the same effect as high humidity. High temperature quickly causes injury to become evident, but the final damage will be much less than with a low temperature.

Investigations to determine the action of the gas on the tissues of the plant show that the immediate effect is a reduction in respiratory activity. Another result is an increase in the permeability of the leaf septa, which causes less rapid intake of water from the stems and more rapid cuticular transpiration. In cases of mild fumigation this results merely in a temporary wilting; in more severe fumigations the wilting is followed by disintegration and death of the tissues. This increased permeability is no doubt due to the reduced respiratory activity. Within a few hours after fumigation the oxidase activity has returned to normal, while the catalase and the respiratory activities have exceeded the normal. The recovery of photosynthetic action, which has been temporarily suspended, then becomes apparent, though complete recovery requires two or three days. Respiration remains above normal for several days. If the increase in permeability is not so severe as to cause death of the tissues, recovery is followed in many cases, as in the tomato, by a rate of growth in excess of normal.

Injured plants should not therefore be condemned too quickly. The stimulation to growth may be due to two factors, namely, the increased activity of the catalase and the increased permeability of the cell-walls, allowing readier exchange of food materials and of gases. All other physiological effects of the presence of hydrocyanic acid in a plant are secondary to the disturbance of the oxidase and catalase activities.

A bibliography of 26 works is given.

SHTCHERBAKOV (Th.). **Допустимо-ли опрыскиваніе мышьяковистыми препаратами сѣменного краснаго клевера?** [Is the Spraying of Red Seed Clover with Arsenical Preparations permissible?] — Reprint from **«Хозяйство.»** [*Husbandry*], *Kiev*, nos. 9–10, 1917, 8 pp. [Received 19th December 1917.]

The author in some of his previous works has refused to acquiesce in the generally accepted view that *Apion* is injurious to clover, and he deals in this article with the recommendation of A. A. Sopotzko as to the spraying of clover with Paris green. On the strength of his own observations and experiments he insists that such spraying is not only not useful, but is actually harmful, as it gives rise to the poisoning of the fertilising bumble-bees and thus to a decrease in the crop of clover seed. No spraying operations ought to be undertaken either during the blossoming of clover or even before that, in April and May, when the queen bees are on the wing.

SHTCHERBAKOV (Th.). **Какъ дѣйствуетъ подкашиваніе на красный клеверъ?** [The Effect of Mowing on Red Clover.]—Reprint from **«Вѣстникъ Сельскаго Хозяйства.»** [*Messenger of Agriculture*], *Moscow*, 1917, 50 pp. [Received 19th December 1917.]

The cutting of clover in June [see this *Review*, Ser. A, iv, p. 298] is one of the remedies recommended for the control of *Apion*. The author, who does not believe in the injuriousness of these weevils, is inclined to regard this remedy as injurious rather than beneficial to the growth of clover. As far as another pest of clover, *Bruchophagus gibbus*, Boh. [see this *Review*, Ser. A, iii, p. 8] is concerned, some figures obtained by the author show that it can hardly be regarded as of serious consequence.

SHTCHERBAKOV (Th.). **По поводу т. н. грушеваго трипса въ Крыму.** [About *Euthrips pyri*, Daniel, in the Crimea.]—Reprint from "*The Transactions of the Museum of the Zemstvo of Taurida*" *for 1914*, *Simferopol*, 1916, 5 pp. [Received 19th December 1917.]

Some specimens of thrips from fruit trees in the Crimea in the summer of 1912 were identified as the American species, *Taeniothrips* (*Euthrips*) *pyri*, Daniel. The author is of opinion that this species should be placed in the genus *Physothrips*, Karny, and further points out that it is a synonym of *T. inconsequens*, Uzel [see this *Review*, Ser. A, v, p. 68]. Only females were found in the Crimea, and for the present it is still doubtful how far it must be considered a pest of pear trees.

Uvarov (B. P.). **Путь къ радикальному разрѣшенію саранчеваго вопроса на Сѣверномъ Кавказѣ.** [The Way to the radical Solution of the Locust Question in North Caucasia.] **« Юго-Восточный Хозяинъ.»** [*The South-Eastern Farmer*], *Rostov-on-Don*, xiii, no. 10, 10th June 1917, pp. 10–13. [Received 19th December 1917.]

The author gives an outline of a scheme for the creation of a central anti-locust bureau for North Caucasia, the drawing up of which has been entrusted to him by a conference of the local authorities of the provinces concerned.

The effective control of locusts in North Caucasia has always been hampered by the absence of proper co-ordination between the respective organisations of various provinces, which are not all equally interested in the destruction of these pests. For instance, the chief breeding places of *Locusta migratoria* in North Caucasia are concentrated on the coast of the Caspian sea, between the mouths of the Terek and Volga, but owing to the scanty population of these localities and their low agricultural development, the economic importance of the pests on the spot is small and the provinces of Terek and Astrachan in which they lie have no reason to indulge in expensive operations for their destruction; this is not the case with the neighbouring province of Stavropol, and the rest of North Caucasia, which are the chief sufferers from the migrating locusts. The organisation of a central bureau for the whole of Caucasia has thus attained an urgent importance, and the above-mentioned conference decided to create such a bureau and to concentrate in its hands the control of locusts over the whole area affected. According to the author's scheme, the authorities of the separate provinces of this area should participate in the organisation of the bureau, financially and otherwise, and should transfer to it everything relating to the control of locusts. The proposed bureau will conduct investigations as to the breeding places and distribution of locusts and be solely responsible for their actual control; its funds are to be provided by grants from the Central Government, its work being of national importance, and also from local contributions. As a controlling body, a North Caucasia Anti-Locust Committee is proposed, consisting of representatives of the Department of Agriculture, the local municipal authorities and entomological organisations, the Director of the Central Bureau being also a member of the Committee. The projected work of the Bureau for each year as well as its reports must be submitted to this Committee for approval.

Rutgers (A. A. L.). **Verslag van den Directeur van het Algemeen Proefstation der A.V.R.O.S., 1 Januari-30 Juni 1917.** [Report of the Director of the General Experiment Station of the General Association of the Rubber-planters of the East Coast of Sumatra, 1st January to 30th June 1917.]—*Batavia*, 1917, 34 pp. [Received 8th December 1917.]

The entomological material received included a small white mite, as yet unidentified, which injured the very young leaves of *Hevea*, both on nursery and older plants. In the case of the former, spraying with lime-sulphur proved very effective, but even better results were

obtained by dusting with flowers of sulphur, an operation easily carried out, a coolie being able to dust 3,600 plants with 4·4 lb. of sulphur in 1½ hours. *Hevea* was also attacked by root-boring Lamellicorn larvae and by leaf-eating beetles, probably a species of *Haltica*. This latter infestation may have been accidental. Besides repeatedly occurring on coffee and tea, Limacodid caterpillars, probably belonging to the genus *Miresa*, were also found on oil-palms.

TOWER (W. L.). **Inheritable Modification of the Water Relation in Hibernation of** ***Leptinotarsa decemlineata.***—*Biol. Bull. Marine Biol. Lab. Woods Hole, Mass., Lancaster, Pa.*, xxxiii, no. 4, October 1917, pp. 229–257.

The results of nine years of experiments on the introduction of *Leptinotarsa decemlineata* [Colorado potato beetle] into a desert environment prove that an alteration of the water relation occurs in ways that are adaptive in direction and inheritable in character. This is due to development in the organism of the capacity to hold water within the tissues, so that the intense desiccation of the dry seasons does not result in death.

The materials used have been pure laboratory strains, the experiments being conducted under cage conditions to eliminate complications due to predaceous enemies, parasites and epidemics. The beetle has two yearly generations, the adult hibernating in the soil, emerging as soon as the spring temperature is high enough and giving rise to the first summer generation that matures in July. This summer generation produces a second, maturing in August or early September, which after feeding prepares for hibernation during September or early October. Throughout the experiments, the food was the cultivated potato, all watering being by irrigation about the roots of the plants.

In hibernation, temperature and humidity in the soil are the two chief factors concerned. Consequently, surviving desert types must be adapted to meet, not only the average hostile conditions, but irregular and extreme manifestations of the environment, often of prolonged duration.

The full capacity for retaining water in the tissues against the influences of a strongly desiccating environment is developed at about the sixth generation after introduction, but whether this is due to changes in the permeability of the cell-membranes or to changes in the colloidal contents of the cells there is no evidence to show, although the slowness of loss of water in the tissues on a sudden fall in temperature to freezing point, indicates the greater probability of the latter.

The question still remains as to whether the alteration is a new or added condition, or the revival of an ancestral one, especially in view of the fact that the reversal of the adapted stock to original conditions has not been found to occur at all readily.

DUPONT (P. R.). **Insect Notes.**—*Colony of Seychelles, Ann. Rept. on Agric. & Crown Lands for 1916, Victoria*, March 1917, p. 13, [Received 10th December 1917.]

The Coccids reported include: *Aspidiotus aldabricus*, sp. n., and *A. longispinus* on bois d'amande, *Pulvinaria pseudo-floccifera* on

Pisonia macrophylla, *Chionaspis solani* on tomato, *Antonina bambusae* on bamboo, *Pseudococcus virgatus* on *Ficus* sp. and *Cassia mimosoides*, and *Coccus* (*Lecanium*) *hesperidum* on *Ficus* sp., etc.

Sooty mould which has been supposed to be a newly introduced pest from Ceylon has probably existed in Seychelles for many centuries and since it is a commensal of scale-insects, it is unfortunate that *Chrysomphalus* (*Aspidiotus*) *dictyospermi*, *A. lataniae* and *Chionaspis inday* have recently been introduced on coconut from Mahé.

Owing to the exportation of copra and poonac (oil-cake residue) having been stopped for over six months for lack of transport, stores of these substances and rotten nuts have been found to be infested with the Coleoptera, *Dermestes cadaverinus*, *Necrobia rufipes*, *Silvanus surinamensis*, *Carpophilus dimidiatus* var. *contingens*, as well as by Dipterous and Microlepidopterous larvae.

Necrobia rufipes is recorded everywhere as breeding in salt fish, more or less decomposed, and its presence in stored copra is supposed to be due to the accidental storage of both in the same room. It is believed to be a purely predaceous insect, feeding on Dipterous and Microlepidopterous larvae, but whether it also destroys the larvae of *Silvanus surinamensis* found everywhere in poonac stored for a short time, is not yet definitely known. The latter beetle can be destroyed by fumigating with carbon bisulphide under a tarpaulin.

Diseases of coconut palms due to insect pests are everywhere prevalent and virulent, the worst being that caused by the beetle, *Melitomma insulare*, which attacks trees that are not well planted. This insect, which is not found attacking other plants, is incapable of prolonged flight. It oviposits near the ground in cracks of the stem that are generally caused by the emergence of aerial roots in neglected plantations. The larvae may be easily removed by excision of the diseased tissues, care being taken to tar or lime the wounds. A severe attack kills a young tree in two years, the usual effect, however, being to weaken the tree during several years till it becomes the prey of other diseases.

The scale-insects infesting coconuts include *Chrysomphalus aonidum* (*Aspidiotus ficus*) (black barnacle scale); *Chionaspis inday*, which usually attacks only mature leaves, except in the case of flamed trees, when it is found on the newly-expanded ones; *Eucalymnatus* (*Lecanium*) *tessellatus* (cinnamon scale); *Aspidiotus lataniae* and *Chrysomphalus* (*A.*) *dictyospermi* (white barnacle scales); and a new scale, *A. ansei*, that attacks the vigorous, unexpanded heart leaves and is a virulent pest that is rapidly spreading. The only relief measure at present possible is the burning of the infected tree on the spot. Leaflets attacked assume a bright yellow colour along the midrib, which renders them conspicuous objects for a long distance. Fortunately scales of the genus *Aspidiotus* are heavily infested by the beneficial fungus, *Cephalosporium lecanii*. Sickly trees, grown under shade and not manured, and flamed trees are predisposed to scale insect attack, and it has been found that *Pandanus* trees growing in moist soil under natural conditions are free from *Hemichionaspis aspidistrae*, while neighbouring trees on rocky banks were heavily infested. A newly introduced scale, *Ischnaspis longirostris* (*filiformis*), is recorded on coconut and oil palms, as well as on Liberian coffee.

GIRAULT (A. A.). **The North American Species of *Habrocytus* (Chalcid-flies.**—*Canadian Entomologist, London, Ont.*, xlix, no. 5, May 1917, pp. 178–182. [Received 12th December 1917.]

This purely systematic paper deals with ten species of the genus *Habrocytus*, of which *H. medicaginis*, Gah., is described from females reared in connection with *Bruchophagus funebris* in red clover seeds: *H. arkansensis*, Gir., from specimens reared in connection with *Isosoma*; and *H. cerealellae*, Ashm., a parasite of *Sitotroga cerealella*.

EHRHORN (E. M.). **Division of Plant Inspection.**—*Hawaiian Forester & Agriculturist, Honolulu*, xiv, no. 10, October 1917, pp. 283–285.

During the month of September a package of seeds and spices from Singapore was found to be infested with weevils and was fumigated with carbon bisulphide, as was also a package of plants by mail, owing to the presence of mealy bug [*Pseudococcus*]. Three boxes of turnips were dumped at sea, being infested with radish maggot [*Chortophila brassicae*].

FULLAWAY (D. T.). **Division of Entomology.**—*Hawaiian Forester & Agriculturist, Honolulu*, xiv, no. 10, October 1917, pp. 285–286.

During the month of September the insectary handled 20,700 pupae of the melon fly [*Dacus cucurbitae*], from which 968 individuals of *Opius fletcheri* were bred and distributed. The following parasites were also distributed:—*Tetrastichus*, 200; *Diachasma tryoni*, 295; *Galesus*, 175; *Diachasma fullawayi*, 90; *Paranagrus* (corn leaf-hopper parasite), 1,200.

MASON (C.). **Report of the Government Entomologist.**—*Nyasaland Protectorate, Ann. Rept. Dept. Agric. for Year ended 31st March 1917, Zomba*, pp. 9–13. [Received 15th December 1917.]

The enormous annual financial loss from cotton bollworm damage shows that uninterrupted scientific work is urgently needed, for although a paying yield is generally obtained, yet bollworms take toll of 75 per cent. of the crop, a fact that gives some idea of the potential cotton-producing capacity of the Protectorate.

Thespesia sp., the only known wild food-plant of the cotton flea-beetle (*Phyllotreta* sp.), was found also to be affected by *Earias insulana*, *E. biplaga*, *Sylepta derogata*, *Dysdercus nigrofasciatus*, *D. intermedius*, *Oxycarenus* sp., *Syagrus morio* and numerous leaf-eating larvae that occur on cotton. Of other cotton pests the Longicorn, *Tragiscoschema wahlbergi*, Fhs. (stem and shoot borer) was noticeably abundant on certain experimental plots, though the insect does not appear to be on the increase; *Phyllotreta* sp. (black cotton flea-beetle) reduced the area under cotton this season by some 3,000 acres; the bollworms, *Earias* and *Heliothis*, caused a loss of approximately £370,000; these species principally attacked squares, flowers and young bolls, their exceptional abundance being due to the destruction of parasites by the severe cold of May and June, 1916, and to the great shortage of

labour. The parasitism of *Earias* is extensive and interesting, heavy hyperparasitism by Chalcids through Ichneumonids occurring, while five species of Tachinids gave a parasitic infestation of over 10 per cent. Early in the season, before squares form, young larvae of of *Diparopsis castanea* occur as borers in leaf-stalks and stem; no parasites of this species have been observed. *Heliothis* (*Chloridea*) *obsoleta*, F., is parasitised by one Ichneumonid and three Tachinids; its accessory food-plants are *Hibiscus rosa-sinensis*, *H. esculentus*, *H. cannabinus*, *Thespesia* sp. (hollyhock), potato, sweet potato, wheat, millet, broom-corn, rice, pigeon-pea, garden-peas, cabbage, cauliflower, radish, turnip, linseed, zinnias and banana. *Prodenia litura*, F. (cotton worm), one female of which laid 1,520 eggs in three days, was not so abundant as in the previous season, being parasitised by five Tachinids and two Ichneumonids; its supplementary food-plants were sweet potato, pigeon-pea, field-peas, velvet beans, broom-corn, cabbage, cauliflower, etc. *Eublemma brachygonia*, Hmp., a bollworm of very minor importance, with similar food-plants, and *Anatrachyntis coriacella*, Snel., the small pink caterpillars of which feed on the seeds of damaged and almost dry bolls, were also reported. The cotton stainers, *Dysdercus nigrofasciatus*, Stål, which is by far the most abundant species, and *D. intermedius*, Dst., which is less important, though abundant in some localities, are preyed upon in the larval and adult stages by *Coturnix delegorguei* (the harlequin quail). A severe attack by cotton aphis [*Aphis gossypii*] was practically stopped in August by the predaceous Coccinellids, *Chilomenes lunata*, F., *C. quadrilineata*, Muls., *Alesia geisha*, Gorh., and *Exochomus nigromaculatus*, Goeze, var. *flavipes*, Thunb. Several Jassid attacks have been reported, but are of very minor importance.

Tea and coffee on one estate were attacked by red spider [*Tetranychus*], for which dusting with flowers of sulphur proved a fairly efficient control, though the treatment did not destroy the eggs. Normal lime-sulphur completely destroyed all stages, but copper sulphate was useless.

The only tobacco pest of importance was *Lasioderma serricorne*, which however does not readily attack new tobacco, the reported damage being due to lack of shipping facilities necessitating storage for over a year.

Richards (R. M.). **The Diseases and Pests of the Coconut Palm.**—*Trop. Agric.*, *Peradeniya*, xlix, no. 4, October 1917, pp. 204–213.

The subject matter of this paper has already been noticed from another source [see this *Review*, Ser. A, v, p. 521].

Dudgeon (G. C.) & Cartwright (W.). **Treatment of Cotton in the Field as a Combative Measure against *Gelechia* attacks.**—*Agric. Jl. Egypt*, *Cairo*, vii, 1917, pp. 120–133. [Received 18th December 1917.]

The severity of an attack of the cotton pest, *Pectinophora* (*Gelechia*) *gossypiella* (pink bollworm), which subsists in the capsule itself, can be mitigated by inducing the plant to mature these at a date earlier

than that on which the insect reaches its maximum development. The severe phase of attack by this bollworm begins in August, and in a bad year almost all young green bolls and flowers, which are attacked in preference to mature bolls, are found to be damaged. Experiments therefore have been carried on to induce the ripening of a maximum portion of the crop at the earliest possible time by progressively withholding water from the plant to hasten maturity without sudden change of conditions. At the same time attempts were made to render the plant distasteful to the pest, which selects moist and shady positions for oviposition, by cutting away the upper shading leaves and branches so as thoroughly to expose the heart of the plant to the sun's rays.

The results of these experiments proved that the reduction of water (within the limits of experiment) does not result in a diminution of yield, does not damage the fibre, ripens the crop earlier, reduces the boll-worm damage, ripens the crop more thoroughly, and thereby lessens residues for boll picking. Further it was shown that topping and stripping of leaves does not result in a diminution of yield, does not damage the fibre and reduces the bollworm attack.

The actual best conditions of watering must obviously depend on climate and soil, but it may be generally stated that water should be reduced after June to the minimum consistent with the health of the plant, and withheld entirely after the first week in August. The question of the best time for topping is also connected with climate, time of sowing and nature of soil, and will require investigation for each district.

ASHBY (S. F.). **Leaf-bitten Diseases of Coconuts.**—*Jl. Jamaica Agric. Soc., Kingston*, xxi, no. 7, July 1917, pp. 269-273.

Leaf-bitten disease of coconuts is being followed in many places by attacks of *Metamasius sericeus* (striped weevil), which is attracted to the rotting patches on the heart leaves. The life-cycle in Barbados occupies 4 days for the egg, 7 weeks for the larva, 10 days for the pupa and several weeks for the adult weevil, the larval being the injurious stage. The adult, being an active flier, doubtless plays an important part in spreading the disease by carrying the spores of the fungus on its body. After treatment of the trees for the disease and as a preventive to new infection that might attract the weevil, an ounce of powdered arsenate of lead may be used to one gallon of Bordeaux mixture, or the Bordeaux can be prepared with sea-water, using 20 per cent. more lime than with fresh water.

DU BUYSSON (H.). **Observations sur des Nymphes de *Coccinella septempunctata*, L. (Col.) parasitées par le *Phora fasciata*, Fallén. (Dipt).** [Observations on the Nymphs of *Coccinella septempunctata*, L., parasitised by *Phora fasciata*, Fallén.]—*Bull. Soc. Entom. France, Paris*, no. 15, 10th October 1917, pp. 249–250.

Observations on nymphs of *Coccinella septempunctata* taken on the upper-surfaces of vine leaves showed them to be deformed owing to parasitisation by a Dipteron, *Phora fasciata*.

PICARD (F.) & LICHTENSTEIN (J. L.). **Un Braconide nouveau,** *Sycosoter lavagnei*, **n. g., n. sp. (Hym.), Parasite de l'** *Hypoborus ficus* **Er. (Col.).** [A New Braconid, *Sycosoter lavagnei*, gen. et sp. n., a Parasite of *Hypoborus ficus* Er.]—*Bull. Soc. Entom. France, Paris*, no. 16, 24th October 1917, pp. 284–287.

This paper deals with a new Braconid genus, *Sycosoter*, closely allied to *Ecphylus*, Först., in structure, but differing from it in having both winged and apterous forms of both sexes. *S. lavagnei*, sp. n., is an external parasite of the larva of *Hypoborus ficus*, on which the egg is laid through the bark of the fig-tree, the emerging larva spinning a cocoon in the gallery of the host, there being apparently the same number of generations of host and parasite. The females in spring are almost all winged; those in the autumn are more often wingless, while winged males occur more rarely than wingless ones, even in spring. At first it was thought that this condition might be due to the shedding of the wings, but the examination of numerous, newly emerged examples has established the fact that this is not the case.

FEYTAUD (J.). **Sur la Reproduction Parthénogénétique de l'Otiorhynque sillonné** (*Otiorrhynchus sulcatus*, **Fabr.**). [On the Parthenogenetic Reproduction of *Otiorrhynchus sulcatus*, F.].—*C. R. Hebdom. Acad. Sciences, Paris*, clxv, no. 22, 26th November 1917, pp. 767–769.

Normal parthenogenctic reproduction is rare among the Coleoptera, though it has been recorded in three species of *Otiorrhynchus*, namely, *O. turca*, Boh., *O. cribricollis*, Gyll., and *O. ligustici*, L. Hitherto *O. sulcatus* has been regarded as a species exhibiting constant sexual reproduction, but the severe infestations of vineyards during recent years having furnished abundant apportunity for observations both in the field and the laboratory, where more than 3,000 individuals were dissected without the discovery of a single male, the conclusion has been reached that the existence of males, though possible, is extremely rare and sporadic in certain generations.

From a practical point of view, this is a fact of the utmost importance, since all the individuals being females, and each one capable of laying 150 eggs, an infestation develops with the greatest rapidity unless energetic steps are immediately taken to control it.

LADMIRAULT (R.). **La Destruction des petits Oiseaux.** [The Destruction of small Birds.]—*Bull. Soc. Nat. Acclimat., Paris*, lxiv, no. 11, pp. 421–426.

This paper urges the protection of all those species of small birds that have proved their usefulness in destroying the larvae of vine-moths in the vine-growing districts of France.

FEYTAUD (J.). **Action des Insecticides sur les Oeufs de l'Eudémis** (*Polychrosis botrana*, **Schiff.**). [The Action of Insecticides on the Eggs of *Polychrosis botrana*, Schiff.]—*Bull. Soc. Etude Vulg. Zool. Agric., Bordeaux*, xvi, nos. 9–10, 11–12; September-October, November-December 1917, pp. 97–105, 117–122.

In a previous series of experiments undertaken by the author in 1911-1912 to test the effects of nicotine, pyridine. quinoline, lead

arsenate, copper and soap sprays on the eggs of *Polychrosis botrana*, it was found that nicotine, pyridine and Bordeaux mixture gave decisive results, the action of nicotine and pyridine consisting in the slow poisoning of the developing larvae, which died at the moment of hatching, while Bordeaux mixture caused the abortion of the eggs [see this *Review*, Ser. A, ii, p. 410, and iv, p. 299].

Later experiments with lime showed that this substance killed the developing larva in the egg by a slow process of dehydration, only those eggs hatching the development of which was well advanced before treatment.

Both lead arsenate and sodium arsenate (anhydrous arsenate of soda 3, neutral lead arsenate 9, water 1,000) [the figures in this and succeeding formulae, in the absence of any definite indication, being taken to represent parts by weight], gave entirely negative results, all the eggs treated hatching normally. Zinc arsenite, however, while not arresting the development of the egg, resulted in the death of the larvae at the time of hatching.

Quinoline 10, sulphoricinate of soda 10, water 1,000, had a most decided effect, all the eggs being immediately killed, owing to its caustic action. Pyrethrum 20, black soap 10, water 1,000, destroyed only 18 per cent. of the eggs, these being in the last stage of development, or partly hatched. Carbolic acid 10, sulphoricinate of soda 10, water 1,000, destroyed all eggs without further development. Potassium permanganate 1 in 1,000 water, or potassium permanganate 10, sulphoricinate of soda 10, water 1,000, proved useless, all the eggs hatching in due course. Potassium sulpho-carbonate destroyed 63 per cent. of the eggs, nearly all of them being in the first stage of development. Tests of the direct effect on the eggs of gelatine and sulphoricinate of soda, which had been used as media for the application of the poisons, showed that they had no effect on hatching. Pyridine 1½ per cent., and oleate of pyridine 2 per cent., prevented the hatching of a certain number of eggs, without however stopping embryonic development; their action resembles that of nicotine and arsenic in poisoning the hatching larvae. Pyridine and pyrethrum should therefore be useful as external insecticides applied directly to full-grown larvae at a time when unhatched eggs are few or absent.

These results explain the special efficacy of nicotine as a preventive, since it is able to destroy 80 per cent. of the eggs treated, and also the superiority of nicotined Bordeaux mixture, which prevents the hatching of 88 per cent. of the eggs.

Le Rhynchite conique (*Rhynchites conicus*, Illg.) ou Coupe-bourgeons. [*Rhynchites conicus*, Illig., the Bud-cutter.] *Bull. Soc. Etude Vulg. Zool. Agric., Bordeaux,* xvi, no. 11–12, November-December 1917, p. 126.

In an article subsequent to that already noticed [see this *Review*, Ser. A, v, p. 569], M. Bordas deals with the principal means of controlling *Rhynchites conicus* in apple and pear orchards. These are, the shaking of the trees every two or three days during May and June in order to collect the adult weevils, the collection and burning of the withered shoots that serve to harbour the larvae, and the use of insecticide sprays. A petroleum emulsion that gave good results was prepared according to the formula :—petroleum 2 parts (by weight),

black soap $1\frac{1}{2}$, carbonate of soda 2, and water from 80 to 90. This emulsion can be improved by the addition of carbon bisulphide, in the proportion of 1 part in 30 by weight.

COLEMAN (L. C.). **Coffee Borer.**—*Planters' Chronicle, Bangalore,* xii, no. 45, 10th November 1917, p. 579.

The most successful measure against *Xylotrechus quadripes* (coffee borer) has proved to be the scrubbing of the bark of trees in areas likely to be attacked. This is effected by means of pieces of coconut husk, a husk being split longitudinally into about four pieces, of which the cut end forms the scrubbing surface, a sharpened piece of split bamboo also being used for the crevices. This treatment, which destroys the eggs laid in crevices and under loose pieces of bark, necessitates two scrubbings with an interval of about a fortnight between them, beginning about the last week in November, since egg-laying extends over a period of 2–4 weeks.

BLANCHARD (F.). **Dégâts causés par les Chenilles du Chou dans le Département de la Loire et dans les Régions avoisinantes.** [Injuries caused by Cabbage Caterpillars in the Department of the Loire and neighbouring Regions.]—*Vie Agric. et Rur., Paris,* vii, no. 50, 15th December 1917, pp. 419–420, 3 figs.

An infestation of *Pieris brassicae* in July and August is described, and the various methods of control are reviewed. Of these the author recommends the crushing of the eggs and young larvae and hand collection of the larger caterpillars, as well as dusting with lime and singeing. He also advocates a trial with decoctions of broom and various insecticides. A warning is given against destroying the cocoons of the parasite, *Microgaster,* which are often mistaken for the eggs of the butterfly.

LAWSON (D. O. K.). **The Striped Cane Weevil.**—*Jl. Jamaica Agric. Soc., Kingston,* xxi, no. 6, June 1917, pp. 219–220. [Received 19th December 1917.]

The larvae of the striped cane weevil [*Metamasius sericeus*] severely damage young cane tops, riddling them with holes, from which a yellow fungus has been observed to grow. On examination, each fungus growth was found to be attached to the body of a dead grub, the disease proving an effective check to the infestation. Except in isolated cases this fungus has not appeared in recent years, but a culture prepared from it might with advantage be used against this pest and the banana root borer [*Cosmopolites sordidus*].

The application of a top dressing of nitrate of soda to fields attacked by the larvae proved effective, though liming the land had not in any way checked the pest. The planting between the canes of cowpeas, which are sprayed with Paris green and ploughed in when about 9 inches high to act as a poison-bait, and the hand collection of the adult weevils are both useful measures.

HANSON (A. P.). **Corn Worm.**—*Jl. Jamaica Agric. Soc., Kingston,* xxi, no. 6, June 1917, pp. 227–228. [Received 19th December 1917.]

The corn worm [*Laphygma frugiperda*] is a most destructive pest of maize, attacking the plant by eating through the stem or by boring

into the pith, while at a later stage the young, folded centre leaves may be eaten back and even the flower-spike may be cut in two. Hitherto no control measures have been systematically employed against this pest, the application of a handful of soil with the idea that soil is an insecticide being worse than useless, while incautious burning of the land should be guarded against, resulting as it does in the destruction of hundreds of lizards, which are valuable natural enemies of this caterpillar. Hand-picking is an inexpensive and effective method of control, doing no appreciable harm to the plant, though it may involve loosening or splitting the leaves.

DANTIN (C. J.). **Elm Galerucella (*Galeruca luteola*) in Spain in 1917.**—*Mthly. Bull. Agric. Intell. & Plant Dis., Rome*, viii, no. 10, October 1917, p. 1446. (Abstract from *La Liga Agraria, Madrid*, xxx, no. 1139, 1917, p. 2.)

The Chrysomelid, *Galerucella* (*Galeruca*) *luteola*, has occurred for many years in Spain, but has never done so much injury to the foliage of elms as in 1917. During July, which was a very hot, dry month, the larvae increased in numbers and voracity and succeeded in defoliating the trees during August. Data on the biology and methods of control of this beetle are given.

SAVASTANO (L.). **Contributo allo Studio sui Rapporti biopatologici della Mosca nera del Fico (*Lonchaea aristella*, Beck.) ed il suo Ospitante nella Penisola Sorrentina.** [A Contribution to the Study of the bio-pathological Relations of the Black Fly of the Fig (*Lonchaea aristella*, Beck.) and its Host-plant in the Peninsula of Sorrento.]—Separate, dated May 1917, from *Ann. R. Staz. Speriment. Agrum. Fruttic., Acireale*, iv, 1916–1917, pp. 113–146, 2 plates. [Received 27th December 1917.]

This paper is supplementary to a previous one [see this *Review*, Ser. A, iii, p. 745] and describes numerous experiments conducted from 1913 to 1915, after which time they had to be discontinued owing to the War. The chief remedial measure is the rejection of susceptible varieties of fig, which are represented in the Sorrento Peninsula by those known as Troiano and Pasqualino; the first is a valuable table fruit, while the second is of little value. A cultural measure reducing infestation is the avoidance of manuring in excess, especially with stable manure. The practice of oiling the figs also diminishes infestation, but to what degree is not known. Two excellent plates illustrate this paper.

SILVESTRI (F.). **Sulla *Lonchaea aristella*, Beck. (Diptera: Lonchaeidae) dannosa alle Infloresecenze e Fruttescenze del Caprifico e del Fico.** [*Lonchaea aristella*, Beck., injurious to the Flower- and Fruit-clusters of the Fig and Capri Fig.]—Separate, dated 10th December 1917, from *Boll. Lab. Zool. Gen. Agrar. R. Scuola Sup. Agric., Portici*, xii, pp. 123–146, 19 figs.

In 1915 Savastano recorded *Lonchaea aristella*, Beck., in the Province of Naples and noted its habits [see this *Review*, Ser. A, iii, p. 745]. The present paper, based on observations made up to December 1917,

in the Province of Naples and on material from other parts of Italy, gives a systematic description of all stages of this fly; Corfu, Spain and Portugal are additional countries where it is known to occur. The larva lives in the inflorescences and fruit of *Ficus carica*, hoth in the Capri fig and domestic fig, hut preferably in the former. In Algeria it is also found in *Ficus pseudocarica*. The adult appears in autumn, and it is in this stage that the insect seems to hibernate. The adult feeds on sugary substances and is a strong flier. In the Portici district newly-laid eggs were found in the inflorescences of the Capri fig from April to November and in those of some varieties of the domestic fig from May to October. The eggs are deposited under the scales at the aperture of the inflorescence either singly or more, usually three in number. In and after May a larger numher of eggs, sometimes up to one hundred, may be found, hut these have prohably been laid by several females. Inflorescences abandoned hy the larvae fall, either at once or after a short time; in the latter case eggs are occasionally deposited through the larval exit-hole inside the larval gallery. In April the egg hatches in eight days, this period being reduced to three days in summer. The method of feeding varies according to the variety of fig; in the case of the Capri fig the larva may enter the exit-hole left by *Blastophaga* and proceed to the galls formed by it, feeding on their soft interior. The larval stage lasts from seven days in August to 24 days in April. Pupation rarely takes place in the fruit, the usual situation being about 1–4 inches deep in the ground. The pupal stage lasts 10 days in May, 9–10 in August, and 16 at the end of October and early in Novemher. The adults from eggs laid early in April appear towards the end of May and from the eggs of this first generation the second generation is produced at the end of June or early in July. The third, fourth and fifth generations appear in July, August and September; during the first two months the life-cycle takes only 19–20 days. There is a sixth generation in August and September. As the adults live about a month and continue to deposit eggs the generations become mingled. The injury is caused by the larva feeding on the styles, ovaries, flower-peduncles and parenchyma of the walls of the interior in inflorescences and in the fruit. Inflorescences that have been well infected by *Blastophaga* are not injured, as the *Lonchaea* larvae are crushed in the distal part of the gall-bearing flowers. In the case of a Capri fig plant with fruit, young inflorescences, and inflorescences with gall-bearing flowers, *L. aristella* oviposits only in the two first-named. The Capri fig is the preferred host-plant and of it the varieties with an elongate, ovoid fruit and well-developed receptacle are best adapted for the development of this insect. The loss as regards the Capri fig is not extensive because of the protection afforded by *Blastophaga*, but the domestic fig suffers severely; in some instances over 50 per cent. of the inflorescences have fallen from this cause.

The pupae of *L. aristella* are parasitised by *Pachyneuron vindemmiae*, Rond., which is also an enemy of *Drosophila ampelophila*. Only pupae on the surface of the ground or at a slight depth are attacked and this parasite is therefore of little use. Poisons are not recommended against *L. aristella*, and the collection and destruction of infested fallen fruit will reduce the infestation to a small extent only. The cultivation of susceptible fig varieties, which vary in different districts,

should be abandoned or limited. The Capri fig must be grown only where it is absolutely required and then only those varieties with inflorescences bearing short, recurved scales at the aperture. In the Province of Naples the practice of smearing the aperture with oil in August (in order to hasten ripening) is an unintentional indirect check, as *L. aristella* does not attack fruit so treated. This operation however injures the quality of the figs and is, in any case, inapplicable to young summer inflorescences (early in July), as it would quickly cause them to fall.

SILVESTRI (F.). **Descrizione di una Specie di *Oscinosoma* (Diptera: Chloropidae) osservato in Fruttescenze di Caprifico.** [A Description of a Species of *Oscinosoma* observed in the Fruit of the Capri Fig.] Separate, dated 12th December 1917, from *Boll. Lab. Zool. Gen. Agrar. R. Scuola Sup. Agric., Portici*, xii, pp. 147–154, 9 figs.

The Chloropid, *Oscinosoma discretum*, Bezzi, is described in order that it may be distinguished from *Lonchaea aristella*, Beck., and from other Dipterous larvae that may attack the fruit of the Capri fig. As yet the author has observed only *O. discretum* in the Province of Naples. It deposits its eggs beneath the scales at the aperture of the ripe fruit and the larvae penetrate to the interior and there feed on the decomposed remains of gall-bearing flowers and on the parenchyma of the walls. They pupate in the ground. In June and July the life-cycle takes about 20 days, as is the case with *L. aristella*. The eggs and larvae have been found only in ripe Profichi and Mammoni figs.

SILVESTRI (F.). **Contributo alla Conoscenza del Celiode del Nocciuolo (*Coeliodes ruber*, Marsh.: Coleoptera, Curculionidae).** [A Contribution to the Knowledge of the *Coeliodes* of the Hazel Nut.]— Separate, dated 14th December 1917, from *Boll. Lab. Zool. Gen. Agrar. R. Scuola Sup. Agric., Portici*, xii, pp. 155–174, 14 figs.

In May 1914, complaints were received from the Caserta district of the injury to young hazel nuts by the Curculionid, *Coeliodes ruber*, Marsham. The only previous record of such injury appears to be that of Trotter in 1904 from the Province of Avellino (*Redia*, ii, p. 54). A description is given of all stages of this weevil, which is distributed throughout Europe and has been observed by the author in Italy and Sicily. The hazel is the only food-plant yet known. The weevils emerge from the ground from mid-January to mid-April. In spring they feed on the parenchyma of the leaves, on the juices of the leaf-peduncles or of the tender shoots and, later on (in May), on the juices of the young nuts; early individuals may also perforate the buds. When disturbed they drop to the ground and feign death, but in the warm hours of the day and when falling from high branches they fly away instead of reaching the ground. In the second half of May and early in June they migrate to the ground and aestivate at a depth ranging from ½ to 3 inches. They emerge at the end of summer or early in autumn and begin feeding again, the male catkins being now attacked. Mating takes place from the end of September to mid-October. Oviposition begins at the end of September and continues

into November. The eggs are laid in the catkins in a hole easily distinguishable from that due to feeding because the female secretes a yellowish, syrup-like fluid which gradually hardens and assumes the colour of honey. Sometimes the eggs are deposited in the galls of *Eriophyes avellanae*, Pag. The adults do not seem to survive the year in which they have appeared. The egg hatches in 8–9 days in September and in 10–11 days at the end of October and early in November. The larva develops in from 15 to 20 days at the end of summer and beginning of autumn; pollen forms the principal part of its food. When mature, the larva bores its way out of the catkin and drops to the ground, into which it burrows to a depth of 4–12 inches, and constructs an oval earthern cell. In autumn it requires about two months to transform into a pupa, so that pupae are to be found in the cells in mid-December, though some larvae are still present undergrown early in March. At Portici an occasional adult was found in a cell as early as 30th December. In the case of individuals developing in the galls of *Eriophyes* the larval stage may be shortened in February and March owing to an increase of temperature. The pupal stage lasts only about a fortnight.

The chief injury done by *C. ruber* in 1914–1917 was to the young nuts, as even a single puncture causes them to wither. A Thomisid spider, *Xisticus lanio*, Koch, has been seen preying on the weevils, but is not of practical importance. The only Hymenopterous parasite observed was a new Ichneumonid, *Thersilochus coeliodicola*, sp. n., of which a description is given. It oviposits in the larva in the catkin. The parasitic larva then feeds on the host while the latter is in its earthern cell, within which it constructs its own cocoon, the adult apparently emerging the same autumn.

The only useful and practical method of combating *C. ruber* is the collection of the adults by shaking the branches in the morning during the first half of May. The best sheet for the purpose measures about 2 yards by 1 yard, each of the longer sides being fastened to a stick. By means of these sticks the sheet can easily be stretched sufficiently to form a shallow gutter in which the beetles collect and which allows of their being easily poured into a sack. Collection would also reduce infestation by *Balaninus nucum*, L. (hazelnut borer). If neglected in May, collecting may be done late in September or early in October.

FROGGATT (W. W.). **The Destruction of Bird Life in Australia.**—Separate from *Australian Zoologist, Sydney*, i, part 4, 8th October 1917, pp. 75-79.

The author, in discussing the cause of the destruction of Australian native birds, points out that the poison-baits used for rabbit extermination have not been the cause of the decrease in their numbers, as many writers have suggested, but that natural causes have been now, as in the past, working to that end. The arrival of settlers, bringing the domestic cat, the progress of civilisation, entailing the clearing of forest land, etc., and the introduction of foreign birds, have all contributed to the diminution of native bird life. On the other hand the multiplication and extension of bird life in Australia is regulated by the conservation of water, and as the pioneer settlers move towards

the interior making great excavations and reservoirs to preserve the water during rainless periods the loss of the many birds that have previously perished during the long droughts will be obviated.

MAYNÉ (R.). **Insectes et autres Animaux attaquant le Cacaoyer au Congo Belge.** [Insects and other Animals attacking Cacao-trees in the Belgian Congo.]—*Etudes Biologie agricole, no. 3*; *Ministère Colonies, Service Agric., Royaume de Belgique, London,* May 1917, 80 pp., 5 plates, 15 figs. [Received 29th December 1917.]

As cacao cultivation is expected to become one of the most important and valuable industries in the Belgian Congo, the author has considered it advisable to include in this list of pests of that plant, not only those species that require immediate control measures, but also those that have been collected in the course of some years' investigations or that have been reported as feeding on cacao, even though their depredations appear at the present time to be quite insignificant, since these under changing external influences may become serious enemies of the cultivated plant.

Insects that attack only the foliage and shoots are :—Coleoptera. RUTELIDAE: *Anomala denuda*, Arr.; MELOLONTHIDAE: *Eulepida reichei*, Thoms., *Pseudotrochalus concolor*, Kolbe, *Aserica variegata*, Arr., *Triodonta procera*, Lansb., *Congella congoana*, Brnsk.; CURCULIONIDAE: *Systates amabilis*, Fst., *S. maynei*, Mshl., *S. ramosus*, Mshl., *Ischnotrachelus anchoralis*, Fst., *Blosyrus dorsalis*, Jck., *Eupiona tripartita*, Fst., *Chaunoderus transversalis*, Fst., *Catascythropus acuticollis*, Kolbe; CHRYSOMELIDAE: *Menius viridiaeneus*, Jac., *M. calceatus*, Lef., *M. parvulus*, Jac. Lepidoptera. HESPERIIDAE: *Rhopalocampta chalybe*, Westw.; LIMACODIDAE: *Parasa vivida*, Wlk., *P. microbasis*, Hmp., *Baria elsa*, Druce; ARCTIIDAE: *Diacrisia maculosa*, Cram.; LASIOCAMPIDAE: *Leipoxais crenulata*, B. Baker, *Gonometa pallens*, B. Baker; LYMANTRIIDAE: *Dasychira niobe*, Weym., *D. endophaea*, Hmp.; Rhynchota. COREIDAE: *Pendulinus carmelita*, Burm. Orthoptera. PHYMATIDAE: *Zonocerus variegatus*, L. Thysanoptera, including three species of thrips.

Insects occurring in diseased parts of the plant are :—Coleoptera. ANTHRIBIDAE: *Gynandrocerus* sp., *Litocerus* sp. Pseudoneuroptera. TERMITIDAE: *Eutermes maculiventris*, Sj., *E. elegantulus*, Sj., *E. parvus*, Hav., *E. latifrons*, Sj., *Rhinotermes lamanianus*, Sj.

The larger borers that attack healthy trees are :—Coleoptera. CERAMBYCIDAE: *Tragocephala anselli*, Bates, *T. maynei*, Gahan, *Moecha adusta*, Har.; BOSTRYCHIDAE: *Apate monacha*, L.; CURCULIONIDAE: *Alcides erroneus*, Thoms., *A. theobromae*, Mshl., *A. aschanticus*, Fst. Lepidoptera. MEGALOPYGIDAE: *Eulophonotus myrmeleon*, Feld. Lesser borers include :—Coleoptera. SCOLYTIDAE: *Xyleborus perforans*, Woll., *Eccoptopterus sexspinosus*, Mots., *Cryphalus* sp., *Hypothenemus* sp., *Platypus* sp., *Crossotarsus* spp.; CERAMBYCIDAE: *Exocentrus ortmansi*, Gah.

Insects causing injuries to the pods that do not degenerate into cankers are :—Coleoptera. ANTHRIBIDAE: *Araecerus fasciculatus*, De G.; CHRYSOMELIDAE: *Menius parvulus*, Jac.; CUCUJIDAE: *Laemophloeus janeti*, Grouv. Lepidoptera. LYMANTRIIDAE: *Euproctis mediosquamosa*, B. Baker; NOCTUIDAE: *Characoma stictigrapta*, Hmp.; PYRALIDAE: *Mussidia nigrivenella*, Rag. Hymenoptera. FORMICIDAE:

Oecophylla smaragdina, F. Rhynchota. PENTATOMIDAE: *Bathycoelia thalassina*, Schout., *Piezosternum calidum*, F.; APHIDAE: *Toxoptera coffeae*, Nietn.; COCCIDAE: *Stictococcus sjöstedti*, Ckll., *Dactylopius* sp., *Ceroplastes* sp. Diptera. TRYPETIDAE: *Ceratitis punctata*, Wied.

Insects causing canker include:—Rhynchota. CAPSIDAE: *Sahlbergella singularis*, Hagl.; *Helopeltis bergrothi*, Reut.; PENTATOMIDAE: *Atelocera serrata*, Westw., *Atelocera* sp., *Haliomorpha annulicornis*, F.; COREIDAE: *Pendulinus devastans*, Dist.

The insects that give rise to cankers are among the most widely distributed and the most injurious to cacao; of these *Sahlbergella singularis*, Hagl., is the commonest in the Belgian Congo and sometimes causes the loss of an entire crop. It occurs also in the French Congo, Kamerun, the Gold Coast and Nigeria. In the Gold Coast it is frequently accompanied by *S. theobromae*, the two species together causing enormous damage [see this *Review*, Ser. A, ii, pp. 141 and 670]. The life-history of *S. singularis* has already been dealt with [see this *Review*, Ser. A, ii, p. 634]. As a check to the increase of this pest, dead twigs punctured by the insects should be cut out and burnt and the sections smeared with coal-tar. The best direct method of control in the Congo is found to be regular inspection of all parts of the plants attacked and the destruction of all larvae and adults thus discovered. This is best done in the early morning. Each worker should carry a vessel containing an emulsion made by dissolving 3½ lb. soft soap in 2 gals. water to which is slowly added 5 gals. petroleum. This is diluted with 5 parts water to 1 part emulsion immediately before use. The addition of Bordeaux to this emulsion will act as a control of secondary fungous pests, and should be applied with a brush to any individuals of *S. singularis* and washed over any cankers suspected of sheltering parasites. All wounds should be smeared with coal-tar and the cankers with vegetable tar. Recommendations are given as to the best method of planting and cultivating the cacao plants in order to avoid either insect or fungous infestations. It has been found inadvisable to plant cacao on the tops of hills as it is much more liable to attack in these situations; a better plan is to plant the valleys with cacao and the side of the hill with coffee. *Eriodendron anfractuosum* (silk cotton-tree) should be eliminated as far as possible on the plantations, as it is on this plant that *S. singularis* develops.

Helopeltis bergrothi, which is a most dangerous enemy of cacao in the East, has not as yet shown great activity in the Belgian Congo, although it occurs in restricted numbers, particularly in the moister parts of the plantations. A considerable increase of this species is considered probable. A key is given to the various African species of *Helopeltis*. The life-history and nature of the damage of *H. bergrothi* has already been described [see this *Review*, Ser. A, ii, p. 671]. Control measures should be undertaken as soon as the insects appear, hand collection being a very successful method as practised by the natives. If the numbers increase, the contact insecticide recommended above for *S. singularis* may be used in the proportion, 1 part emulsion to 10 or 12 parts water. The food-plants of *H. bergrothi* in the Congo in addition to cacao are:—*Funtumia elastica*, *Manihot utilissima* (cassava), sweet potato, *Bixa orellana*, castor-oil plant, *Cyrtosperma senegalense* and an Aroid found in marshes. Patterson's lengthy list of food-plants in the Gold Coast is also given.

Work connected with Insect and Fungus Pests and their Control.—*Rept. Agric. Dept. St. Kitts-Nevis for 1916–1917, Barbados*, p. 12 and p. 36. [Received 29th December 1917.]

During the year ending March 1916, grasshoppers were reported as being very destructive, necessitating the use of poisoned bran mixture. Cockroaches also injured very young cotton in some districts, but were kept in check by a poisoned bait of 1 part Paris green to 40 parts of maize meal.

In 1917, Mr. W. I. Howell reported from Nevis the prevalence of *Alabama argillacea* (cotton worm), little damage, however, being done to the cotton crop, while *Eriophyes gossypii* (leaf-blister mite) was less numerous than for some time past. Early in August a species of *Lachnopus* did a considerable amount of damage to cotton locally, Paris green and lime proving ineffective against this pest; better results were obtained by collecting the insects in kerosene and water.

The Pink Boll Worm.—*Agric. News, Barbados*, xvi, no. 406, 17th November 1917, p. 362.

The dispersion of *Pectinophora gossypiella* over widely separate areas is not effected by the flight of the adult moth, nor by the transport by the wind of larvae in loose cotton lint, but by the agency of man in importing and distributing cotton seed or baled cotton without previous inspection. In this connection may be cited the case mentioned by Houston in the *Scientific American* for 4th August, of a cotton-seed oil mill established in a town on the borders of Mexico and the United States, to which large quantities of infested seed are being moved; the emergence of moths from this, occurring as it does within a few miles of the Texas cotton fields, cannot fail ultimately to establish this pest in a new region. The infested area in the Laguna district of Mexico is much larger than was at first supposed, and the distribution of seed from this is increasing the area of infestation. These two cases serve to emphasise still more strongly the importance of quarantine measures.

Boyd (A. J.). **Cotton Cultivation in Queensland.**—*Queensland Agric. Jl., Brisbane*, viii. no. 4, October 1917, pp. 185–191.

The worst insect pest of cotton in Queensland is the bollworm [*Heliothis obsoleta*] which, however, owing to its preference for maize as a food-plant can be controlled by the planting of trap-crops. The best plan to adopt is that of leaving 5 rows vacant between every 25 rows of cotton, one of which should be planted as soon as possible with an early-maturing variety of maize. As soon as the ear-silk appears, examination should be made for the eggs of the moth, and when all these have been found and removed, the plants may be cut down and used for stock feeding. Following this, three more rows of maize should be planted, or maize alternating with cowpeas, in which case the peas must be sown when the maize has appeared above ground. By December these three rows should be silking, and the large number of eggs to be found on them should be allowed to mature to prevent the destruction of parasites on the eggs and larvae. When the whole generation has been parasitised, the ears may be destroyed, and the

fifth and last row of maize should be planted to trap the eggs of the few remaining moths that have matured, these being destroyed by burning.

The success of this method depends entirely on the maize being in tassel in December, to ensure which, it must be planted considerably later than the normal time of planting in spring.

Duncan (R. S.). **The Farmer's Apple Orchard.**—*38th Ann. Rept. Ontario Agric. & Experimental Union for 1916, Toronto,* 1917, pp. 62–67. [Received 31st December 1917.]

In the course of this paper the importance of spraying as an investment, and the necessity for proper equipment are emphasised. A summary of spraying rules against the commoner insect and fungus pests of apple orchards is given.

Jones (T. H.). **The Sweet-Potato Leaf-Folder.**—*U.S. Dept. Agric., Washington, D.C.,* Bull. no. 609, 22nd November 1917, 12 pp., 4 figs.

The only recorded damage to sweet potato by the larva of the Pyralid moth, *Pilocrocis tripunctata*, F. (*cubanalis*, Guén.), is that reported in 1915 from Porto Rico, though this species is known to occur in Texas, Mexico, Costa Rica, Jamaica, Cuba and Grenada.

The eggs are laid singly or in small irregular groups on the under-surface of the leaf, frequently alongside the leaf-veins. They hatch in four days, and the larvae undergo six moults in 13 days, after which they construct cocoons within which they pass the prepupal period of 2 days in the case of the summer generations (the last generation, however, hibernating in the last larval instar); a pupal stage of 6 days completes the 25 day life-cycle.

This pest, which has five generations in the year, and which damages the plant by practically skeletonising the leaves, can be successfully controlled by spraying with a solution of zinc arsenite powder, 1 lb. in 40 U.S. gals. water in which 12 lb. cactus detritus has been soaked for 20 hours previously to increase the adhesiveness, or with a solution of 1 lb. lead arsenate powder in 50 U.S. gals. water, one early application being sufficient.

Two parasites have been reared from the larvae, a Tachinid, *Exorista pyste*, Wlk., and an Ichneumonid, a new species of *Bassus*, while the larvae are attacked by the adults of *Podisus maculiventris*, Say (spined soldier-bug). The jackdaw or boat-tailed grackle, *Megaquiscalus major macrourus*, is predaceous on the larva.

de Ong (E. R.). **Hydrocyanic-acid Gas as a Soil Fumigant.**—*Jl. Agric. Research, Washington, D.C.,* xi, no. 9, 26th November 1917, pp. 421–436, 1 plate, 10 tables.

The study of the use of hydrocyanic acid, the most effective substance known as a soil fumigant in orchards and greenhouses, entails the establishment of a definite ratio between the minimum point of toxicity to insects and the maximum dosage that is safe for germinating seeds and plants, together with a knowledge of the physical and chemical action of the gas in the soil, the rate and extent

of diffusion and absorption by soil water, the alteration of concentration of the gas caused by soil particles, and its decomposition by certain soil constituents.

Experimental investigations on these points have shown that the toxicity of hydrocyanic gas solutions varies with the insects experimented upon, from the minimum for house-flies (*Musca domestica*) of ·0156 gm. sodium cyanide per litre (equivalent to ·0046 per cent. of hydrocyanic acid gas over the solution) to the maximum for beetles (*Diabrotica soror*) of ·125 gm. per litre (equivalent to ·0365 per cent. of hydrocyanic acid gas over the solution), the latter being the most resistant of any insect experimented upon. The gas at a concentration fatal to house-flies only slightly retards the germination of lettuce seeds, which were not killed even by a two days' exposure to gas nearly three times as strong as that toxic to beetles. In the case of seedlings it was found that a solution 256 times as strong as that producing gas toxic to flies killed all the seedlings and half of the cuttings placed in it, while a solution twice as strong as that required against flies had no effect even upon seedlings. In short, a dosage toxic to flies and *Phylloxera* would be safe for all plants experimented upon, while that necessary for beetles, would be extremely dangerous if not fatal.

As regards the introduction of the gas into the soil, it was found impossible to effect this by injecting sodium cyanide solutions into the ground, or by forcing in the gas under pressure, owing to soil and water both being strong absorbents of the gas. Retention of the gas depends upon the character of the soil, a heavy, damp or very wet, sandy soil being almost impervious to the gas, which is taken up by a pure sandy soil only in proportion to the amount of water present, and in a clay soil is either decomposed or changed in concentration by the soil particles. Attempts to generate the gas in the earth showed that it diffuses with extreme slowness in clay soils or very wet sandy soils, but much more rapidly in fairly moist sand.

The conclusion reached is that sodium cyanide affords a satisfactory means of fumigating masses of loose, porous soil, especially those containing little clay, also seed-beds and potting soil, but that the cost, while comparable with that of carbon bisulphide fumigation in light soils, is not within the range of economy except in small areas, even when the value of the gas as a nitrogenous fertiliser is considered, the fumigation of heavy soils being very much more expensive.

HEWITT (C. G.). **Report of the Dominion Entomologist for the Year ending 31st March 1917.**—*Dominion of Canada, Dept. Agric., Ottawa*, 1917, 24 pp. [Received 29th December 1917.]

The arrangement whereby the Governments of the provinces of Nova Scotia and British Columbia under supervision of the Department of Agriculture carry out fumigation of foreign nursery stock destined for those Provinces is proving very satisfactory. Details are given of inspection work in connection with the control of brown-tail moth [*Nygmia phaeorrhoea*, Don.], in Nova Scotia and New Brunswick. In continuation of the work of colonisation of parasites of this pest and of the gipsy moth [*Lymantria dispar*], no less than 15,725 puparia of

Compsilura concinnata have been reared and were forwarded in July for colonisation at various points in eastern Canada. The total number of parasites imported up to date are: *Apanteles lacteicolor*, 67,500; *C. concinnata*, 30,725; *Calosoma sycophanta*, 4,200.

Investigations respecting the natural factors controlling or tending to control the abundance of certain highly injurious insects revealed the fact that in the control of *Hyphantria textor* (fall webworm) the red-eyed vireo, *Vireosylva olivacea*, L., is the most important factor, about 40 per cent. of the larvae being destroyed by this bird at five observation points. The most useful enemy of *Lepidosaphes ulmi* (oyster-shell scale) was found to be a predaceous mite, *Hemisarcoptes malus*. Woodpeckers destroyed most of the cocoons of *Samia cecropia* (emperor moth). The problem of the natural factors controlling the Tortricid, *Cacoecia* (*Archips*) *cerasivorana*, in a region where the insect does not appear to increase in numbers, is being investigated. The introduction into Canada of *Mesoleius tenthredinis* for the control of *Lygaeonematus* (*Nematus*) *erichsoni* (larch sawfly) has already been described [see this *Review*, Ser. A, v, p. 347].

Insects affecting grain and field crops have been under investigation; the life-histories of *Lachnosterna gibbosa*, *L. fusca*, *L. dubia* and *L. rugosa* (all species occurring in Ontario), and of *L. rugosa*, *L. dubia*, *L. grandis* and *L. nitida* in Manitoba and Saskatchewan have been studied, and the data collected will be published. Cutworms were the cause of serious damage, particularly *Euxoa ochrogaster* in Manitoba and eastern Canada and *E. excellens* in British Columbia, some of the latter being destroyed by the fungus, *Sorosporella uvella*. Poisoned bran mixture was found very useful for controlling these. *Chortophila* (*Phorbia*) *brassicae* is apparently increasing in numbers and destructiveness throughout Canada; in experiments for the control of *Hylemyia antiqua* (*Phorbia ceparum*) sodium arsenite gave promising results. A severe outbreak of *Cephus* sp. (western wheat-stem sawfly) occurred in Manitoba and Saskatchewan. In the same provinces *Mayetiola destructor* (Hessian fly) is being investigated. *Ceramica picta* (zebra caterpillar) stripped the foliage of turnips, cabbage and kale in Ontario and the Maritime Provinces. Cabbages and turnips were also attacked by a new Tortricid pest, *Tortrix wahlbomiana* var. *vigaureana* (*oleraceana*).

Other destructive insects were *Bruchus pisorum* (pea weevil), *Pemphigus betae* (beet aphis) and *Psila rosae* (carrot rust fly). *Thrips tabaci* (onion thrips) was largely controlled by the predaceous bug, *Triphleps tristicolor*. Greenhouse pests include *Callopistria floridensis* (Florida fern caterpillar), *Dasyneura rhodophaga* (rose midge), *Eumerus strigatus* (narcissus bulb fly), *Diarthronomyia hypogaea* (chrysanthemum midge) and *Tarsonemus pallidus* (cyclamen mite).

In eastern Canada much attention has been given to the control of insects affecting apple [see this *Review*, Ser. A, v, pp. 343–346 and 549]. In Quebec sprays for *Anthonomus quadrigibbus* (apple curculio) have been tested [see this *Review*, Ser. A, iv, p. 480]. The mite, *Tetranychus pilosus*, was abundant on plums and apples and the silver-leaf mite, *Phyllocoptes schlechtendali*, on peaches in the Niagara District. In British Columbia the life-history and control of *Taeniothrips inconsequens* (*pyri*) (pear thrips) has been studied [see this *Review*, Ser. A, v, pp. 70 and 117]. *Rhagoletis pomonella* (apple

maggot) has been recorded from British Columbia [see this *Review*, Ser. A, v, p. 581]. *Otiorrhynchus ovatus* (strawberry root weevil) was studied in Vancouver [see this *Review*, Ser. A, v, p. 469]. Larvae of *Polyphylla decemlineata*, Say, and of *Aristotelia* sp. were also injurious in strawberry plantations.

Forest and shade-tree insects have been the subject of special study [see this *Review*, Ser. A, v, pp. 550–551, 568]. It is intended to undertake co-operative work with the forest plant pathologists, as it is felt that in this way a more speedy solution may be found to several obscure problems of tree injury.

Investigation into the question of insects affecting stored grain and other products disclosed the fact that serious losses do not occur to stored grain owing to the rapid movement of the grain crop and the extremely low temperatures prevailing in districts where grain is stored locally. The possibility of treating rice infested with *Calandra oryzae* by means of high temperatures was investigated, and the results indicated that rice would not withstand the high temperature necessary. The value of superheating a ship's hold by steam in order to destroy this weevil was successfully demonstrated. It is hoped that the practice of controlling insects infesting mills, warehouses, etc., by high temperatures will be more generally adopted, this method being cheaper, safer and easier of application than fumigation.

KEILIN (D.). **On the Supposed First Stage Larva of** *Leptohylemyia coarctata*, **Fall.**—*Bull. Entom. Research, London,* viii, no. 2, December 1917, pp. 121–123, 2 figs.

The conclusion arrived at by Kurdjumov that the eggs described by him represent the overwintering stage of *Leptohylemyia coarctata* [see this *Review*, Ser. A, ii, p. 350] is criticised by the author, who considers that these eggs do not belong to the developmental cycle of this insect, but were probably introduced into the breeding vessel with earth from outside, this conclusion being based on the structure of the mouth-parts, of the posterior end of the abdomen and of the posterior spiracles of the primary larva described by Kurdjumov.

NEWSTEAD (R.). **Observations on Scale-Insects (Coccidae)-V.**—*Bull. Entom. Research, London,* viii, no. 2, December 1917, pp. 125–134.

This paper deals with a large number of Coccids including:—*Icerya aegyptiacum*, Doug., from Zanzibar on date palm; *Stictococcus multispinosus*, Newst., from the Gold Coast, on kola, a small percentage of the females being attacked by Chalcidid parasites, and from Uganda, on *Markhamia platycalyx*; *S. sjöstedti*, Ckll., from Gold Coast, on cacao; *Pseudococcus citri*, Risso, from British East Africa and Uganda, on coffee; *P. sacchari*, Ckll., from Madras, on rice, and from British Guiana, on sugar-cane; *P. virgatus*, Ckll., from Uganda, on coffee, from Zanzibar, on cassava and sugar-cane, from the Gold Coast, on French beans, *Jatropa curcas* and *Colocasia*, and from Southern Nigeria, on cacao seedlings; *Phenacoccus insolitus*, Green, from Madras, on egg-plant; *Tachardia decorella*, Mask., from Uganda,

on *Anona muricata*; *Asterolecanium coffeae*, Newst., from British East Africa and Uganda, on coffee, a small percentage being infested by Chalcidid parasites; *Cerococcus hibisci*, Green, from South India, on egg-plant; *Ceroplastes cajani*, Mask., from South India, on red gram [*Cajanus indicus*], *Zizyphus*, *Ocimum sanctum* and wild indigo; *C. personatus*, Newst., from Gold Coast, on *Coffea liberica*, being the only additional record since its discovery in 1898; *C. rubens*, Mask., from South India, on mango, and from Zanzibar, on young orange trees; *Pulvinaria cupaniae*, Ckll., from Jamaica, on mulberry imported from the United States; *P. psidii*, Mask., from British East Africa and Uganda, on coffee, and from South India, on mango and guava, the Uganda specimens being parasitised by a fungus; *Saissetia nigra*, Nietn., from South India, on cotton, from Uganda, on coffee, and from British East Africa, on ornamental shrubs; *Coccus viridis*, Green, from British Guiana, on Liberian coffee, and from S. Africa; *Hemilecanium imbricans*, Green, from S. India, on *Cedrela tuna*; *Chrysomphalus aurantii*, Mask., from British East Africa, on orange tree, from Southern Rhodesia, where it is heavily infested by a fungus, apparently a species of *Nectria* and also parasitised by a Chalcidid, from S. Africa, on *Acacia*, from Jamaica, on citrus imported from India, and from Fiji, on bananas; *Aspidiotus cyanophylli*, Sign., from Uganda, on peach, and from Fiji, on bananas; *A. destructor*, Mask., from S. India, on coconut, about 70 per cent. being destroyed by a small Coleopterous larva, from Zanzibar, on mango and castor-oil plant, from British East Africa, on coconut, from Uganda, on banana, mango, guava, screw-pine, Ceara rubber and *Hevea brasiliensis*, and from Gold Coast, on mango; *Chrysomphalus aonidum*, L. (*ficus*, Comst.), from S. India, on mango and *Ficus* sp.; *Pseudaonidia fossor*, Newst., from British Guiana, on grape-vine; *A. orientalis*, Newst., from British East Africa and S. India, on tamarind and egg-fruit; *Selenaspidus silvaticus*, Lind., from Uganda, on *Citrus aurantium*; *S. articulatus*, Morg., *Fiorinia proboscidaria*, Green, *Parlatoria pergandei*, Comst., and *Parlatoria ziziphus*, Lucas, all from Jamaica, on citrus imported from India.

BRAIN (C. K.) & KELLY (A. E.). **The Status of Introduced Coccids in South Africa in 1917.**—*Bull. Entom. Research, London*, viii, no. 2, December 1917, pp. 181–185.

This record of scale-insects introduced into S. Africa contains the names of 55 well-established species constantly met with during nursery inspections, together with their known distribution. Others that have been stopped at the port of entry, such as *Eulecanium* (*Lecanium*) *bituberculatum*, Targ., *E.* (*L.*) *corni*, Bch., *Pulvinaria betulae*, L., *Aulacaspis* (*Diaspis*) *rosae*, Bch., *Aspidiotus pyri*, Licht., and *A. ostreaeformis*, Curt., are not included.

The more important established species include: *Icerya purchasi*, Mask., widely distributed, but satisfactorily controlled by *Novius cardinalis*; *Pseudococcus citri*, Risso; *P. filamentosus*, Ckll.; *P. virgatus*, Ckll.; *Saissetia hemisphaerica*, Targ.; *S. nigra*, Nietn. (*S. nigrella*, King.); *S. oleae*, Bern.; *Aspidiotus destructor*, Sign.; *A. perniciosus*, Comst.; *Chrysomphalus dictyospermi*, Morg.; and *Lepidosaphes pinnaeformis*, Bch.

GOWDEY (C. C.). **A List of Uganda Coccidae, their Food-plants and Natural Enemies.**—*Bull. Entom. Research, London,* viii, no. 2, December 1917, pp. 187–189.

Among the 72 species recorded in this list are included :—*Tachardia decorella,* Mask., parasitised by *Aenasiella africa,* Gir., and *Coccophagus nigropleurum,* Gir., and preyed upon by the caterpillars of *Stathmopoda orsteëtis,* Meyr. ; *Pulvinaria jacksoni,* Newst., parasitised by *Tetrastichus gowdeyi,* Crawf. ; *Ceroplastes galeatus,* Newst., parasitised by *Neomphaloidella ceroplastae,* Gir., *Eurytoma galeati,* Gir., and *Scutellista cyanea,* Mots. ; *Inglisia conchiformis,* Newst., preyed upon by a Lepidopterous larva, *Eublemma scitula,* Ramb. ; *Saissetia oleae,* Bern. parasitised by *Coccophagus saintebeuvi,* Gir. ; *Stictococcus diversiseta,* Silv., preyed upon by *Eublemma costimacula,* Saalm. ; *S. gowdeyi,* Newst., parasitised by *Coccophagus comperei,* Gir., and *Epitetrastichus ugandensis,* Gir. ; *Aspidiotus destructor,* Sign., preyed upon by *Epilachna punctipennis,* Muls.

ZACHER (F.). **Ein neuer Schädling der Kartoffelpflanze.** [A new Pest of the Potato Plant.]—*Deutsche Landwirtschftl. Presse, Berlin,* xliv, no. 65, 15th August 1917, p. 481.

In June 1917 a potato field in the district of Teltow was reported to be heavily infested with beetles. An immediate investigation showed that these were not the Colorado potato beetle, *Leptinotarsa decemlineata,* but a leaf-beetle, *Galeruca tanaceti,* L. Observations led to the conclusion that the pest had migrated from adjacent marshy meadows owing to lack of food due to the prolonged drought. Owing to the shortage of chemicals due to the War, collection of the beetles is advised and, as they do not fly readily, steep-sided trenches will prevent many from reaching the potato plots. Rainy weather would cause them to leave the potatoes as their usual food-plants would become available.

LEGISLATION.

The Indian Destructive Insects and Pests Act 1914.—*Planters' Chronicle, Bangalore,* xii, no. 43, 27th October 1917, p. 550. [Received 3rd December 1917.]

Orders have recently been passed bringing this Act into force and are explained in a recent Government Order, which states that no plant is to be imported into British India by land or sea by means of the letter or sample post. No plants, except fruits and vegetables intended for consumption, potatoes and sugar-cane are to be imported into British India by sea except after fumigation with hydrocyanic acid gas and at one of the ports prescribed in the Act.

Plants that are infested with living parasitised insects and are intended for the introduction of such parasites may be imported without such fumigation if accompanied by a special certificate from the Imperial Entomologist to the Government of India that such plants are imported for the purpose of introducing such parasites.

The Insect Pest and Quarantine Ordinance, No. 5 of 1901.—*Ceylon Govt. Gazette, Colombo,* no. 6,912, 23rd November 1917.

Additional regulations to those published in 1916 provide that from

1st January, 1918, no tea plants or parts of them other than leaf for manufacture or tea seed shall be removed from any estate or nursery, whether infested with shot-hole borer [*Xyleborus fornicatus*] or not, without a written permit from the Director of Agriculture. From 1st January 1920, no such permits shall be granted for the removal of any tea stumps or plants from any infested area, and no person shall remove or receive from any infested area tea plants or any part of them.

Laws of Maine relating to Agriculture.—*Maine Dept. Agric. Qtrly. Bull., Augusta*, xvi, no. 4, December 1917.

In that part of the agricultural laws of Maine as amended in 1917 relating to the protection of trees and shrubs from dangerous insects and diseases, revised statutes provide for the appointment of a State horticulturist to deal with the question. The gipsy moth [*Lymantria dispar*, L.] and the brown-tail moth [*Nygmia phaeorrhoea*, Don.] are declared public nuisances and their suppression is authorised and required under the charge of the Commissioner. Nurseries are to be inspected annually and the State horticulturist may inspect any orchard, field or garden and order the destruction of diseased trees or shrubs. Any nursery stock shipped into the State is to bear a certificate of inspection, is to be again inspected at the point of destination, if required by the State horticulturist, and destroyed or returned at the consignor's expense if he shall so elect. Transportation companies are not to transport uninspected stock and the Commissioner of Agriculture is to be notified of all consignments received for transport. All agents and dealers in nursery stock are required to have a license. Any person suspecting the presence of the brown-tail moth [*Nygmia phaeorrhoea*] or of San José scale [*Aspidiotus perniciosus*] on trees, shrubs or vines within the State are to send a notice accordingly to the Commissioner of Agriculture, who will then proceed to have these inspected and treated. Owners of real estate that is found to be infested will be notified that these insects must be destroyed within a specified time. The expenditure of money raised in towns for the purpose of controlling these insects is regulated by the Commissioner of Agriculture. Municipal officers are required to destroy all dead or worthless apple and wild cherry trees along the public ways before 1st June of each year. Municipal and police courts and trial justices are empowered to deal with prosecutions in respect of these regulations. The Crop Pest Commission already established may direct the Commissioner of Agriculture to make such regulations as the Commission deem necessary to prevent the introduction into the State or the dissemination therein of any insect pest or plant disease seriously injurious to vegetation.

Under these regulations it has been resolved, and approved, on 30th March 1917, to appropriate the sum of approximately £7,000 for the protection of trees and shrubs from insects and diseases during the year 1917, and a similar sum during 1918.

Regulations dealing with adulterated or misbranded goods define the standard required for the most commonly used insecticides and regulate the penalties for violation of these laws.

Trägårdh (Ivar). **Våra vanligaste Barkborrar och deras Gångsystem.** [Our most common Bark-beetles and their Galleries.]—*Statens Skogsförsöksanstalt,* Flygblad no. 8, February 1917, 28 pp., 27 text-figs. [Received 16th February 1918.]

This paper is a popular treatise on the characteristic features and systems of the galleries of bark-beetles, their feeding habits, choice of trees, etc.

The following species are dealt with :—*Myelophilus piniperda,* L., *M. minor,* Htg., *Hylastes ater,* Payk., *Dendroctonus micans,* Kug., *Hylurgops palliatus,* Gyll., *Polygraphus poligraphus,* L., *Ips typographus,* L., *I. sexdentatus,* Boern., *I. proximus,* Eichh., *I. acuminatus,* Gyll., *Pityogenes bidentatus,* Hbst., *P. quadridens,* Htg., and *P. chalcographus,* L.

Ips proximus is recorded for the first time from Sweden, where it seems to be common. It has undoubtedly been previously overlooked owing to its great resemblance to *I. laricis,* and its occurrence has been recorded under that species.

Trägårdh (Ivar). **Om de klimatiska Faktorernas inflytande pa Insekternas uppträdande.** [On the Influence of Climatic Factors on Insects.]—*Särtryck ur Skogshögskolans Festsskrift 1917, Stockholm,* 1917, pp. 428–447, 7 figs. [Received 16th February 1918.]

After an introductory discussion of the different factors influencing the numerical variation of injurious insects, an attempt is made to analyse the meteorological conditions during some outbreaks in Sweden.

In the summer of 1911, *Aphis* (*Siphonaphis*) *padi,* L., did great damage to cereals in southern Sweden. Tullgren, who described the outbreak, suggests that the high temperature and the low rainfall were the causes of the great increase in the numbers of this Aphid. An analysis of the temperature during May–August in 1910 and 1911 shows, however, that the difference during these years was too small to render it likely that the temperature played any important part.

The difference in the rainfall during May–August, on the other hand, was very marked, the total amount in 1910 being about 11½ inches, whereas in 1911 it was only about 6 inches or 53 per cent. of that of the previous year. It is also notable that in 1910 heavy rains occurred at the beginning of July at the very time that the Aphids had just migrated from bird-cherries to the cornfields, where they were more exposed. It therefore seems probable that in the summer of 1911 the absence of the controlling factor exercised by high precipitation brought about the great increase in the numbers of this aphis.

As regards *Lymantria* (*Liparis*) *monacha,* L., in Sweden and the serious outbreaks of it in 1898–1902, it is of special interest to note that it occurred not only in the chief centre in Kolmården, but simultaneously in other parts of Sweden, which at once suggests that climatic conditions played an essential part. An analysis of the temperature and rainfall during 1896–1898 elicits the fact that the mean temperature in the neighbourhood of Kolmården during April–August in 1896 and 1897 was about 3° F. higher, and nearly 3½° F. higher in Kristianstad, than in 1898. The rainfall during April–July in 1896 was only 40 per cent. of that of 1897, and nearly the same applies to Kristianstad for the years 1896 and 1897.

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These analyses do not, however, give any real insight into the significance of the altered climatic conditions, and the author, after reviewing the work of other writers on this question, points out that a solution of these problems can be arrived at only by further investigations.

TRÄGÅRDH (Ivar). **Undersökningar over gran- och tallkottarnes skadeinsekter.** [Investigations on the Insects injurious to Spruce and Pine Cones.]—*Meddelande fran Statens Skogsförsöksanstalt, Stockholm,* 1917, Häfte 13–14, pp. 1141–1404, cxxxvii–cxlvi, 44 figs. English Summary. [Received 16th February 1917.]

In this paper, which forms the introductory portion of the investigations, only the most common of the injurious insects which are found on spruce cones collected during the winter and their parasites are dealt with. The investigations were based on about 14,000 cones collected from different parts of Sweden and kept in breeding cages of the so-called American type.

Cydia (*Laspeyresia*) *strobilella*, L., occurs all over the country. The parasites of this moth previously known were :—*Nemeritis cremastoides*, Holm., *Ephialtes glabratus*, Ratz., and *Bracon anthracinus*, Nees (?). To this number the author was able to add only one species, *Epiurus geniculatus*, Kby. Of these parasites *Nemeritis cremastoides* is distributed all over the country and occurs in 78 per cent. of the localities, in many of which it attacked more than 20 per cent. of the larvae. *Ephialtes glabratus* seems to be far less common, occurring in only 25 per cent. of the localities, in only one of which did parasitism reach more than 20 per cent., while in 73 per cent. of the localities in which it occurred only 5 per cent. of the caterpillars were attacked. *Bracon* sp., formerly referred to as *B. anthracinus*, is not yet definitely identified, though it is closely allied to that species. It is common all over the country, having been found in 67 per cent. of the localities. The importance of these species is considerably increased by the fact that they occur together and in many localities more than 39 per cent. of the caterpillars was parasitised by one or the other of them. *Epiurus geniculatus* is very rare, having been found only in three localities. It seems likely that it is in reality a parasite of *Dioryctria* (*Phycis*) *abietella* and has only occasionally been present in the cones because its host was killed before it had time to leave them.

The spruce-seed midge, *Perrisia strobi*, Winn., was bred from cones as long ago as 1848, but nothing was known regarding the feeding habits of the larva. In 1895 Nitsche found the larvae of a gall midge in spruce seeds, but failed to breed them, and in Germany no further attempts seem to have been made to solve this problem [see however this *Review*, Ser. A, vi, p. 5]. In Finland Sahlberg in 1890 bred a gall midge from spruce seeds which he identified with *P. strobi*. The fact that investigators on the one hand found larvae in the seed, which they failed to breed, and on the other found cocoons in the scales from which gall midges emerged, gave rise to the view that two different species occurred. This, however, is not the case ; the larvae feed in the seeds, leaving these before pupation and entering the scales, where they form the characteristic white cocoons. These cocoons are easily found on cutting a cone in two ; they are flask-shaped, rounded at the bottom and tapering towards the mouth, which corresponds to an irregular

opening in the upper side of the scale, made by the larva in order to facilitate the extrusion of the pupa half-way through the opening, in which position the midge emerges. The biological significance of this peculiar mode of pupation becomes evident when it is remembered that the seeds fall to the ground, whereas the cones remain on the trees. If they remained in the seeds and fell to the ground with them, the midges would have a considerable distance to travel to find another individual to mate with or suitable places for oviposition, besides being exposed to numerous enemies. Pupating in the cone-scales they emerge in the crown of the trees and close to the spot where their eggs are laid, being, moreover, well protected in the scales during the pupal period. The fact that pupation takes place in the scales is therefore doubtless an adaptation which ensures the protection of the species. *Platygaster* (*Triplatygaster*) *contorticornis*, Ratz., was bred by Ratzeburg from spruce cones and was suspected by him of being the parasite of *P. strobi*, but until now this had not been definitely proved. The larva of *Platygaster* is parasitic in that of *Perrisia*, but does not kill its host until it has left the seeds and formed the cocoons in the base of the scales, the inflated skin of the larva serving as an extra cocoon for the parasite. *Platygaster* is present with its host all over the country, though it was very remarkable that in 1916 in the northern part of the country it was not bred in those localities where *Perrisia* was very abundant, whereas in the south of Sweden a high percentage of *Perrisia* always corresponded to a high percentage of *Platygaster*. The majority of those localities from which the cones gave a low percentage of *Platygaster* being situated in the north of Sweden, these data seem to justify the inference that in this part of the country climatic conditions have been favourable to the reproduction of *Perrisia* but not of its parasite. That this species is a very effective parasite of *Perrisia* is shown by the fact that in 25 per cent. of the localities the percentage of midges killed by it was 11–20; in 13 per cent., 21–30; in 10 per cent., 31–40; in 14 per cent., 41–50; and in 5 per cent., over 50 per cent. Its value is increased by the fact that the females are far more numerous than the males, while in *Perrisia* the number of both sexes is about equal.

At the beginning of the investigation it seemed very likely that some species of the genus *Megastigmus* would be found in spruce seeds, two species of this genus being recorded in Germany with this habitat. It is, therefore, very remarkable that during the investigation of these 14,000 cones the author entirely failed to breed any species of *Megastigmus*, the part played by this genus in Central Europe being evidently taken in Sweden by *Torymus azureus*, Boh. The mode of pupation of *Torymus* seems to be the same as that of *Perrisia*, the burrows of the former being, however, easily distinguished from those of *Perrisia* owing to the absence of white cocoons. When the adult is ready to emerge, the pupa does not become extruded half-way through the opening, but remains in the burrow, the adult biting a circular hole through the wall.

The two sexes of *Aprostocetus strobilanae*, Ratz., were described as two different species by Ratzeburg, who called the male *Geniocerus erythrophthalmus* and the female *Eulophus strobilanae*. This mistake has not hitherto been corrected, Schmiedeknecht in the "Genera Insectorum" referring the male to *Tetrastichus* and placing the female

in *Entedon.* This species has not been definitely proved to be the parasite of *Torymus azureus,* though very strong circumstantial evidence of this exists. *A. strobilanae* occurs all over the country and seems to surpass even *Platygaster* in effectiveness. While the latter in 63 per cent. of the localities only killed up to 20 per cent. of *Perrisia*, the corresponding figure for *Aprostocetus* occurs in 30 per cent. of the localities. The curves of both species fall at 50–60 per cent. infection, but while the largest number of localities for *Platygaster* is to be found where there is no parasitism, the corresponding figure for *Aprostocetus* coincides with a parasitism of 30–40 per cent. The curve of *Aprostocetus*, however, at the higher percentage of parasitism is very peculiar, rising from 71 to 80 per cent., so that no less than 12 per cent. of the localities show an infestation of 91–100 per cent. The localities where there is such high percentage prove on examination to be precisely those where *Perrisia strobi* was very numerous, while *Platygaster* was either very scarce or did not occur at all. This seems to show that some correlation exists between these facts. The larvae of *Perrisia* and *Torymus* both live in the seeds of the spruce and consequently compete for the same food-supply. The data of bred individuals show that the former appears earlier than the latter, and there is no reason to suppose that this succession is altered under natural conditions. Hence, if a high percentage of the seeds are attacked by *Perrisia* the possibility of *Torymus* finding a sufficient supply of seeds decreases, and its number is reduced. At the same time the increase of *Platygaster contorticornis,* the normal parasite of *Perrisia,* has been checked, presumably owing to climatic conditions. When therefore, *Aprostocetus* appears, it finds a large number of seeds attacked by *Perrisia* larvae that are not parasitised, and only a few *Torymus*, and in consequence it is forced to attack the former instead of the latter.

KEMNER (N. A.). **Gulhåriga skinnarbaggen** (*Blitophaga opaca* **L.**)—*Centralanstalten för Jordbruksförsök,* Flygblad no. 62, June 1916; *Entomologiska Avdelningen,* no. 15, 4 pp., 2 figs. [Received 14th February 1918.]

This Silphid beetle has repeatedly injured sugar-beet, potatoes and barley in Sweden. The adults hibernate in the ground under stones and moss and are markedly nocturnal in their habits, being very sluggish during daytime and, when disturbed, dropping to the ground and hiding themselves under stones. The eggs are deposited in the ground with the aid of the ovipositor and covered with earth. The larvae are full-grown in about three weeks and pupate in the soil, the adults emerging after about a fortnight. There is only one generation a year. This beetle occurs all over Sweden, attacking sugar-beet in the south and barley in the north. Suggested remedies are spraying with lead arsenate and rolling the ground.

KEMNER (N. A.). **Ärtviveln** (*Sitona lineatus* **L.**)—*Centralanstalten för Jordbruksförsök,* Flygblad no. 63, June 1917; *Entomologiska Avdelningen, Stockholm,* 1917, no. 16, 4 pp., 5 figs. [Received 14th February 1918.]

This paper contains a short description of the biology of *Sitones* (*Sitona*) *lineatus* and the remedies employed to deal with it. The

adult weevils hibernate in moss and under dry leaves and appear in the spring, attacking the leaves of Leguminosae, especially of beans and peas. When quite young the plants generally succumb, though larger plants do not suffer greatly, even if the loss of foliage amounts to 10–20 per cent. Later in the season the larvae attack the roots of the plants, especially the bacterial nodules. The number of eggs laid is probably not high, a female in captivity producing only six larvae. The larvae become full-grown in from four to six weeks, and in the middle of July the pupae are found in cells beneath the plants. Rotation of crops is recommended as a remedy.

KEMNER (N A.). **Rapsbaggen** (*Meligethes aeneus*, **F.**)—*Centralanstalten för Jordbruksförsök*, Flygblad no. 64, June 1917. *Entomologiska Avdelningen*, no. 17, 4 pp., 3 figs. [Received 14th February 1918.]

As a rule only one annual generation of *Meligethes aeneus* occurs in Sweden, though during warm summers two may be present. This Nitidulid beetle is distributed all over the country and is common everywhere. In 1892–1895 it did so much injury to the rape fields of Gotland that the cultivation of this plant had to be abandoned. It seems questionable whether spraying with arsenicals is advisable, since it has been ascertained that this may interfere with the bearing of the plants. The author, therefore, suggests the use of nets. During the outbreak in Gotland, Lampa with the help of a net collected no less than 133,000 beetles in 15 minutes, 95 per cent. of which were *Meligethes*. Another method which has proved very useful in Germany is the so-called Sperling's apparatus, consisting of boards covered with tar, which are dragged between the rows about a foot above the ground.

KEMNER (N. A.). **Björksäckmalen** (*Coleophora fuscedinella*, **Zell.**) **och dess uppträdande åren 1915-1917.** [The Birch Sack-moth, *Coleophora fuscedinella*, Zell., and its Occurrence in Sweden in 1915–1917.]—*Meddelande från Centralanstalten för Försöksväsendet på Jordbruksområdet*, no. 162; *Entomologiska Avdelningen*, no. 28, 28 pp., 30 figs. [Received 14th February 1918.]

During the years 1915–1917 birches over a large part of Sweden were attacked by *Coleophora fuscedinella*, Z. The moths appeared in the end of June and the beginning of July; they are somewhat nocturnal in their habits and are therefore easily overlooked, the damage done by the caterpillars being sometimes ascribed to frost. The eggs are deposited on the smallest twigs, on the half-opened leaves and on the scales of the buds, two or three together, and are concealed as much as possible. The larva hatches in a fortnight and makes a blotch-mine in a leaf. A new mine is afterwards made which forms the case of the larva and concealed in this it makes other mines in the leaves. As the larva increases in size it adds small rings of leaf to the anterior margin of the case, which becomes horn-shaped. In this case hibernation takes place, the larva deserting the leaves and attaching the case to a twig in the autumn. In May of the following year, the larva leaves its winter quarters and begins to attack the young leaves one after another, doing at this time far more damage than during the previous autumn. In many localities the birches

were practically defoliated, and when this was repeated the following year they succumbed. In many localities, especially in Smaland during 1915, 10–20 per cent., and in 1916, 50–90 per cent. of the birches were defoliated.

The following parasites were bred from the larvae:—*Hemiteles* sp., *Itoplectis maculator*, F., *Glypta* sp., *Phobocampa* sp., *Agathis varipes*, Th., *Apanteles* (?) *sodalis*, Hal., *Pezomachus instabilis*, Forst., *Angitia* sp., *Apanteles corvinus*, Reinh., *A. xanthostigma*, Hal., *A. mesoxanthus*, Ruschka, sp. n., *Microdus mediator*, Nees, *Habrocytus radialis*, Th., *Dibrachys boucheanus*, Ratz., *Elasmus viridiceps*, Th., *Cirrospilus pictus*, Nees, *Miotropis sulcicrista*, Th., *Chrysocharis elongata*, Th., and *Genioceras charoba*, Walk.

KEMNER (N. A.). **Stjälkbocken (*Phytoecia cylindrica* L.) ett skadedjur pa flockblomstrigs växter bl. a. pa morotplantor for fröskörd.** [*Phytoecia cylindrica* L., an Enemy of the Umbellatae, including Seed Carrots.]—*Meddelande från Centralanstalten för Jordbruksförsök*, no. 139; *Entomologiska Avdelningen*, no. 26, 8 pp. 8 figs.

In the botanical department of the Agricultural Experiment Station at Stockholm, the Longicorn beetle, *Phytoecia cylindrica*, did great injury to seed carrots in the autumn of 1915. The stems of the plants were pierced through by the larvae from one or two feet above the ground down to the roots. On lawns in the neighbourhood where *Anthriscus silvestris* grew in great numbers, about 90 per cent. of this plant was injured in the same way. There is one annual generation, the eggs being laid during the summer and the larva hibernating and completing its metamorphosis in early summer of the following year. The pupae are found in old, dry stalks. The attack not only greatly diminished the crop, but only 30 per cent. of the seed obtained germinated.

TULLGREN (A.). **Landtbruksväxternas fiender och vänner bland de lägre djuren.** [The Enemies and Friends of Agricultural Plants amongst the lower Animals.]—*Stockholm*, 1917, 142 pp., 68 figs. 4 coloured plates.

This is a popular treatise on the agricultural pests of Sweden and their parasites, especially adapted for the use of the agricultural schools. It contains a short introductory chapter dealing with the systematic position of insects, their classification, morphology and development, and the different kinds of injury caused by them. In the subsequent chapters the different pests are treated according to their systematic position. The last chapter deals with methods of control and a key arranged according to the different types of injury is appended.

HOTTA (G.). **Cha no shakkakuchu ni kwansuru chôsa.** [Geometrids injurious to the Foliage of Tea.]—*Special Report of Tea Plantation Experiments, Prefecture of Shidzuoka Agric. Expt. Station*, October 1917, 21 pp., 3 plates.

The report contains descriptions of the early stages, habits and life-histories of six species of GEOMETRIDAE found in Japan injurious to the foliage of tea, viz.: *Jankowskia fuscaria*, Leech, *Boarmia theae*, Mats.,

Gonodontis obliquaria, Moore, *Lycia robustum*, Butl., and *Boarmia selenaria*, Hb. Other food-plants of these moths previously recorded by other entomologists or from the author's own experiments are :— For *T. fuscaria*: *Thea japonica*, *T. sasanqua*, *Acer palmatum*, *Pyrus floribunda* and *Prunus tomentosa*. For *B. theae*: *Prunus communis*. For *L. robustum*: *Eurya japonica*, and *Pyrus malus* var. *tomentosa*. For *B. selenaria*: *Morus alba*. Keys to the larvae and imagines are appended.

Preventive measures are also discussed. As the eggs are laid under the bark of pine trees near the tea plantation, they should carefully be searched for and collected. Spraying with a mixture of insect-powder, soap and water, while the larvae are still young, is also recommended.

ISHIWATA, SHIGETANE. **Note on a Species of *Nosema* infecting *Attacus cynthia*, Drury.**—*Jl. of Parasitology, Urbana, Ill.*, iii, no. 3, March 1917, pp. 136–137, 8 figs.

This paper describes a species of *Nosema*, closely allied to *N. bombycis*, Näg., found in dead larvae of *Attacus cynthia*, Drury.

ANDERSON (S. F.). **Outdoor Culture of the Grape-vine in New Zealand.** —*Jl. Agric., Wellington, N.Z.*, xiv, no. 4, 20th April 1917, pp. 278–292, 4 figs. [Received 2nd January 1918.]

Grape-vines in New Zealand are not greatly troubled by insect pests. *Phylloxera* is confined to a few localities in the far north of the Dominion, and need not be present there if the growers would take advantage of the resistant grafted vines available from the horticultural stations. *Cryptoblabes gnidiella* (*Albinia wokiana*) and *Thyridopteryx herrichi* spin webs among the fruit and eat the stems of the berries at the time when these are about half grown. The remedy is a spray of 1¼ lb. arsenate of lead to 50 gals. water. *Pseudococcus* (mealy bug), which is the most serious pest of vines cultivated under glass, is not of much importance in vineyards, except where there is a general neglect of pruning and cleaning; in such cases the best treatment is the removal of all rough, scaly bark after pruning, and syringing with hot water.

CAMPBELL (J. A.). **Work for the Coming Month. The Orchard.**—*Jl. Agric., Wellington, N.Z.*, xiv, no. 4, 20th April 1917, pp. 308–311. and xv, no. 5, 20th October, 1917, pp. 221–226. [Received 2nd January 1918.]

San José scale [*Aspidiotus perniciosus*] is the most prolific and destructive of all orchard insect pests, and, although easy to destroy, is most difficult to eradicate, as any small number of individuals that escape spraying are sufficient to start a new infestation, which rapidly attains the same extent as the previous one. If the scraping of trees to remove rough bark was made compulsory, as it is in Tasmania for the control of codling-moth [*Cydia pomonella*], it is probable that the difficulties of eradication of this scale, which shelters under the bark, would be greatly minimised. The greatest amount of damage to fruit-trees is done from the time the sap ceases to flow until the scale becomes dormant, which in a mild season is well into the winter. In order to

check this injury in the early autumn it is advisable to spray before pruning. Oil emulsion is the most reliable spray, but cannot with safety be applied to peach trees so early, and for this reason lime-sulphur 1 : 15 is preferable.

General recommendations for summer sprays are as follows:—On pip-fruits, for codling moth [*Cydia pomonella*], leaf roller [? *Tortrix postvittana*] and pear slug [*Eriocampoides limacina*], arsenate of lead powder 1 lb., or paste 1½ to 2 lb., to 50 gals. water. For bronze beetle and brown beetle, ¾ gal. resin solution should be added. For woolly aphis [*Eriosoma lanigerum*], Black leaf 40, 1 to 800, combined with arsenate of lead. For red mite [*Tetranychus*] and other sucking insects, Black leaf 40, 1 : 800; lime-sulphur, 1 : 100 or 1 : 120, or atomic sulphur, 10 lb. to 100 gals. water, combined with arsenate of lead. On stone-fruits, for red mite, whale-oil soap and atomic sulphur, 8 lb. to 100 gals. water.

LESNE (P.). **Carabides nuisibles aux Fraisiers.** [Carabids injurious to Strawberries.]—*Jl. d'Agric. Pratique, Paris,* xxx, no. 26, 27th December 1917, pp. 504–505.

Among the Carabids there are a number of genera that are normally phytophagous, such as *Zabrus, Ditomus,* etc., or omnivorous, such as certain species of *Amara,* as well as some carnivorous species that devour the sweet pulp of certain fruits; these include *Carabus, Calathus,* etc. Beetles of both categories are found attacking the ripe fruit of strawberries, especially *Pterostichus melanarius,* Ill., *Steropus madidus,* F., and *Calathus fuscipes,* Goeze. *Ophonus ruficornis* attacks only the seeds, but the slight wound left on the fruit in tearing these out is however sufficient to cause a rapid deterioration, and these attacks have been known to ruin as much as one-fifth of the crop. In the forests of Central Europe *O. ruficornis* also devours the seeds of conifers and other plants in the seed-plots that are covered with boards to protect them from the attacks of small rodents and birds. Seeds of *Maclura aurantiaca* have been devoured on more than one occasion, proving that this species is definitely phytophagous. *O. ruficornis* is nocturnal, flying freely on warm summer nights, and can travel some distance to reach its preferred food-supply. *Harpalus distinguendus* is another Carabid that has also caused damage to strawberries in the neighbourhood of Poitiers.

The question of controlling these Carabids on strawberry beds has not been solved. The straw that is laid on the ground to keep the fruit clean unquestionably encourages the presence of nocturnal insects that find shelter in it during the day. It is considered probable that traps might be advantageously used in such cases: handfuls of grass or squares of matting kept in a moist condition and scattered in the beds would doubtless attract many insects and allow of the capture of a number of them each day.

Reports of County Horticultural Commissioners.—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento,* vi, no. 11 & 12, November-December 1917, pp. 415–482.

This bulletin contains an article from each of the county horticultural commissioners in the State of California, the subjects being as varied

as the interests of the counties represented. Systematic examination and interception of imports arriving by rail and post are carried out and many insect pests and diseases are thus prevented from entering the State, while a continuous patrol for the purpose of discovering insect infestations is maintained. Much help is given to entomologists in the colonisation of parasites, the common Coccinellid, *Hippodamia convergens* being distributed largely by the commissioners. The insectary at Alhambra is investigating the mealy bug [*Pseudococcus citrophilus*] which has caused so much damage to the orange-growing industry. Experience has shown that this pest can be controlled in a great measure by natural enemies, provided that the Argentine ant [*Iridomyrmex humilis*] be kept from the trees. Tests for ant control are being made with bands, poisons and trap-nests. The distribution of the Sicilian mealy bug parasite [*Leptomastix*] is being undertaken, and it is hoped to colonise large numbers during the next season. Several newly-introduced Coccinellids are being tried, as well as some native predators, such as the brown lacewing [*Hemerobius pacificus*] and *Leucopis*.

The enforcement of the Fresh Fruit Standardisation Law, which became effective on 27th July 1917, has resulted in a great diminution in the quantity of infested and diseased fruit coming to the Almeda County arkets. In Martinez, pear-trees were heavily infested with *Eriosoma pyricola* (pear root aphis), and dwarf pears were eventually substituted for the French variety with good results. Cotton-growing has now become established in Imperial County and is free from any serious insect pests. *Lygus pratensis* (tarnished plant bug), *Bucculatrix* sp. (cotton leaf perforator), *Heliothis obsoleta* (cotton bollworm), crickets, grasshoppers and Aphids are all present, but in small numbers. The cotton boll weevil [*Anthonomus grandis*] and the pink-bollworm [*Pectinophora gossypiella*] have so far been rigorously excluded.

Grapes in many localities are badly infested with the grape mealy bug, *Pseudococcus bakeri*. Soon after the last moult the adult females make their way to the maturing grape clusters, settle down and feed on the berries, with the result that large quantities of honey-dew are exuded, which spoils the fruit for the market. Experiments in control are being conducted by the United States Department of Agriculture. It is already evident that control measures cannot be adopted during the growing season, but are best applied during early spring before the leaves appear. The young insects are then feeding on the tender cambium of the spurs, having emerged from their winter quarters underneath the old bark ; a driving spray directed towards the crevices from every angle will then kill large numbers.

In Los Angeles County a great variety of plants and trees are grown, nearly all of which are host-plants for some species of insect pest ; it is therefore not surprising that more than £50,000 is spent annually in their control, the enforcement of the laws providing for insect control being in the hands of the county commissioners.

In Marin county the most common and persistent pests are Aphids. They are largely controlled by native Coccinellids, but these appear so late in the season that spraying is necessary to prevent injury to young fruit. Scale-insects are also troublesome, having a large range of food-plants and being difficult to control, spraying or fumigating often being impracticable. They have not as yet, except in a few localities,

caused serious losses to the fruit crop. The black scale [*Saissetia oleae*] was formerly a serious pest of ornamental and fruit trees, but has now been greatly reduced by its natural enemy, *Scutellista*. The cottony cushion scale [*Icerya purchasi*], formerly a serious menace to ornamental trees, has been to a large extent controlled, and would be better checked if *Novius* (*Vedalia*) *cardinalis* were more plentiful; this Coccinellid for some reason is not multiplying rapidly. The codling moth [*Cydia pomonella*] rarely appears on apples in the coast districts, but in the interior is a serious pest. Hitherto it has been necessary to depend upon voluntary action on the part of growers to keep the pest in check, but it is hoped that the new Standard Apple Act will produce better results. The growing of currants for commercial purposes has practically been abandoned owing to the currant fruit fly [*Epochra canadensis*]. The growing of beans has been much interfered with by the prevalence of the two-spotted mite [*Tetranychus telarius*], but dry sulphur has proved a satisfactory treatment for it. *Anarsia lineatella* (peach twig borer) was for many years the cause of losses amounting to as much as 50 per cent. of the peach crop; this pest is now absolutely controlled by the use of lime-sulphur spray in the spring when the blossom buds are swelling.

Spraying of citrus trees against scale-insects in San Bernadino has led to the conclusion that it is not as efficient as fumigation, is more expensive and causes greater injury. Sprays containing arsenic are apt to cause severe scorching of the fruit, dropping of leaves and dead wood, while miscible oils cause defoliation and spotting or dropping of fruit. Sulphur sprays frequently scorch the fruit, when applied during high temperatures; a large quantity of soap also seems to bleach or discolour the trees and scorch the fruit. Kerosene and oil distillate, when properly emulsified, did little visible damage and when carefully applied controlled the scales as well as any other spray. All sprays, when strong enough to kill scale-insects, do more or less injury to citrus trees, and these are only recommended in the case of very young trees that might be injured by a fumigation tent or for trees that it is impossible to fumigate.

The advisability of clearing away all weeds and rubbish in the autumn, and of taking down fences with their accompanying weeds wherever possible, is strongly urged as being of great assistance in the control of brown mites, potato tuber moth [*Phthorimaea operculella*], various Aphids, thrips, cutworms, grape root worm [*Fidia viticida*] and many other pests.

During recent years fruit-growers on the Pacific Coast have been waging an uphill fight against increasing losses from the depredations of various Aphids; apples, prunes, walnuts and pears have all suffered heavily. In particular, the appearance of the pear root aphis [*Eriosoma pyricola*] has necessitated some control being used for this pest and it was found that Black leaf 40, 1 part to 1,000 parts water, poured into the soil around the roots practically freed the trees from the root-infesting forms. The experiment was then tried of planting a plot with tobacco, the refuse from this growth being chopped up and placed in trenches around the fruit-trees, 5 lb. being used for each tree. This was first applied in November and the rest towards the end of February; the second application seemed to be the most successful and an orchard badly attacked by both this species and *Eriosoma lanigerum*

is now entirely free from infestation. The waste from cigar factories can be obtained cheaply for use in this way, and can be made into a spray of the same strength as a 1 to 2,000 dilution of Black leaf 40 to which may be added 6 lb. commercial flour paste jelly to 100 U.S. gals. water and 10 lb. atomic sulphur. Though this treatment for root-infesting forms of Aphids is still in the experimental stage, it is considered worthy of recommendation to growers.

Experiments in the control of *Coccus citricola* (grey scale) on citrus trees in Tulare County again proved the superiority of fumigation over spraying. In spraying the bad effects are often not evident until the following year, when there is frequently, as in the case of pyrox, more or less severe injury to the smaller twigs, while the useful Coccinellid, *Novius cardinalis*, is destroyed by it.

BROCK (A. A.). **The Control of Walnut Aphis** (*Chromaphis juglandicola*).—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, vi, no. 11 & 12, November-December 1917, pp. 478–479.

Considerable injury occurs to walnut trees in Santa Paula County owing to the depredations of *Chromaphis juglandicola*, a heavy infestation in one year usually being succeeded by a light one in the following year. In 1917 the infestation promised to be very severe in the early summer and spraying experiments were started as soon as the conditions warranted treatment. Half a pint of nicotine sulphate to 4 lb. whale-oil soap with 200 U.S. gals. water was found quite efficacious in killing the Aphids, though a stronger solution acted more quickly. Predators assist considerably in control of this aphis; the chief are the Coccinellids, *Olla abdominalis* and *Psyllobora taedata*, less important ones being *Coccinella californica*, *Hippodamia convergens* and *H. ambigua*. In a moist season a fungus destroys this Aphid in large numbers. The effect of spraying showed that trees so treated are much less damaged by hot weather than unsprayed ones, probably because they put out new growth that protects the nuts. They were also free from the sooty mould, which always follows the attacks of *C. juglandicola*. A tobacco dust spray with lime or sulphur as a carrier promises to be an effective and economical method of controlling this pest, though the liquid spray is recommended as a better all-round treatment in the case of severe infestation.

VOLCK (W. H.). **The Apple Leaf-mining Case-Bearer** (*Coleophora volckei*).—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, vi, no. 11 & 12, November-December 1917, pp. 463–467, 6 figs.

For several years past an unusual type of injury to apples in Pajaro Valley, California, has been observed, one or more small punctures appearing in the skin and extending a short distance into the pulp. This injury was found to be due to a new species of case-bearing larva, the life-history and habits of which were studied during 1916. The presence of the insect on the fruit is evidently accidental, the foliage being the principal food. The first eggs were observed in the laboratory in early July; they are placed on the under-side of the leaves among the plant hairs and are so small as to be difficult to find. The flat side of the egg is tightly pressed against the leaf-surface, and upon hatching

the young larvae bore directly into the leaf through the bottom of the egg. For one or two instars the young caterpillars remain within the leaf as true leaf-miners, the first larvae in cases being observed on 13th August. After loosely attaching the edge of the case to the leaf-surface, the larva eats through the epidermis and begins to feed on the interstitial cells. Feeding continues during summer and autumn, hibernation beginning early in November when the larvae are about one-fourth grown. Hibernation continues within the case until the blossoms begin to open in the following spring. It is these spring larvae that are likely to injure the fruit. There are apparently two spring moults, and the larvae grow rapidly until pupation, which lasts from the middle of May to the middle of June.

While *C. volckei*, Heinrich, increases but slowly, having only one generation in a year, it is so well protected by its case and its leaf-mining habits that control is difficult. The case, and the habit of exclusively internal feeding, completely protects this species from arsenical sprays in the summer and lime-sulphur in the winter. Oil emulsions, unless applied with great thoroughness and at very concentrated strength, fail to kill the hibernating larvae. Natural enemies, one of which reared from this species has been identified as a species of *Microbracon*, are very few in number, the parasitism of the pupae never having exceeded 3 per cent. Attempts have been made to destroy the larvae by defoliation of the trees as soon as the fruit is picked; this however is difficult to effect as the defoliation has to be very rapid, the fruit seldom being entirely picked before mid-October and hibernation beginning in November. Neither crude oil emulsion nor lime-sulphur solutions were successful as defoliators, and the larvae on trees so treated were as abundant as elsewhere. Caustic solutions with sodium nitrate proved too strong and killed the foliage too quickly to allow of shedding. Contact insecticides were then tried early in the spring, when the larvae were leaving hibernation. Trees were sprayed on 5th April with 3 lb. nicotine sulphate to 8 lb. flour (worked into a paste) and 12 lb. milled sulphur, made up with 200 U.S. gals. water. A second application was given on 2nd May. The results showed a great reduction in the numbers of *C. volckei* on the sprayed trees, but the table given shows that the control of the codling moth [*Cydia pomonella*] and the fruit-tree leaf-roller [*Cacoecia argyrospila*] is not so effective by this means as with arsenicals.

MASKEW (F.). **Quarantine Division. Report for the Months of August and September, 1917.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento,* vi, no. 11 & 12, November-December 1917, pp. 483–484.

The following pests were intercepted:—From Australia: *Eulecanium corni* and mites on gooseberry plants. From China: *Cylas formicarius* in sweet potatoes. From Guatemala: *Ceraputo* sp. on orchids. From Hawaii: *Coccus longulus* on betel leaves; *Diaspis bromeliae* and *Pseudococcus bromeliae* on pineapples; Trypetid larvae in decayed peaches and cucumbers; weevils in seed pods. From India: *Pseudococcus* sp. on pomelos. From Japan: *Aulacaspis pentagona* on a cherry tree; Lepidopterous larvae in beans and dried figs: *Pseudaonidia duplex* on camellia; weevils in dry herbs and roots

and sweet potatoes. From Java: *Calandra oryzae* in rice; *Pseudococcus* sp. on pomelo. From Nicaragua: *Spermophagus pectoralis* in beans. From Tahiti: Borer larvae in dry citrus wood. From Arizona: *Heliothis* (*Chloridea*) *obsoleta* on maize. From Central America: *Aspidiotus cyanophylli* on bananas. From Colombia: *Diaspis boisduvali*, *Chrysomphalus perseae* and *Isosoma orchidearum* on orchids. From Louisiana: Lepidopterous larvae on vines; *Lepidosaphes ulmi* on apples; and *Aspidiotus cyanophylli* on bananas. From Mexico: Coleopterous larvae in coquita nuts. From New York: *Diaspis boisduvali* and *Eucalymnatus tessellatus* on orchids; *Pseudococcus* sp. on crotons and other ornamental plants. From Washington: *Venturia inequalis* on apples. From Florida: *Hemichionaspis aspidistrae* on ornamental plants. From Oregon: Codling moth [*Cydia pomonella*] in pears.

Horton (J. R.). **Three-lined Fig-tree Borer.**—*Jl. Agric. Research, Washington, D.C.*, xi, no. 8, 19th November 1917, pp. 371–382, 3 plates.

The three-lined fig-tree borer, *Ptychodes trilineatus*, L., is a large Cerambycid beetle that does considerable damage to fig-trees (*Ficus carica*) by boring into the larger branches and trunks. It occurs throughout the southern United States and has been reported from parts of Mexico, all the States of Central America, the West Indies, Venezuela and Colombia, and Tahiti.

The greatest amount of damage is done by the larvae, which bore in both dry and green wood, preferring that which is partly dead and has lost some of its sap; hence they principally attack trees or branches that are diseased or injured.

The eggs are inserted into the bark near wounded or decaying spots, and rarely, if ever, in perfectly sound healthy bark; they usually occur singly, though as many as five may be found together.

Those individuals that complete their larval stage in one season have an average larval life of three months, while overwintering ones live in the wood for about 11 months. As they are feeding during most of this time, the possible amount of damage that they may do is great.

The larvae, which, though soft-bodied, are extremely resistant to mechanical injury, tunnel to a point near the surface when ready for pupation, and emerge after a pupal period of 24 days by cutting a circular exit-hole through the bark. The adults, which feed on the tender bark of the smaller fig stems and also during the fruiting season upon ripe and nearly ripe figs, have an average life of 3 or 4 months.

Emergence of the adults takes place from March to early December, the maximum being reached in September. There is no true hibernation period, but only one of comparative inactivity from December to February inclusive.

The chief remedy is the prevention of infestation by keeping the trees in the healthiest condition possible, avoiding injury by breaking limbs, or bruising the bark in cultivating and picking the fruit, and treating wounds with a protective paint composed of five parts of coal tar and one part of creosote. The borers may in some cases be killed by injecting carbon bisulphide into the tunnels and plugging the openings with putty, but this method is impracticable where the infestation is severe and well advanced.

WADE (O.). **The Sycamore Lace-bug (*Corythuca ciliata*, Say).**—*Agric. Expt. Sta., Stillwater, Oklahoma*, **Bull. no. 116, July 1917, 16 pp.,** 7 figs. [Received **3rd January 1918.**]

The Tingid bug, *Corythuca ciliata*, is widely distributed throughout the United States, being found wherever its host-plant, *Platanus occidentalis* (western sycamore or buttonwood tree), thrives. It has not, as yet, been found on other host-plants, though it attacks two allied trees, *P. wrighti* in Arizona and New Mexico and *P. racemosa* in California, but has never been found on *P. orientalis* (eastern plane tree).

Injury to the foliage is caused by the adults, which live and breed exclusively on the downy under-surface of the leaf. The insect hibernates in the adult stage under the loose, rough bark of the trunk, and occasionally in cracks and crevices of neighbouring fences, being able to withstand a temperature of 10° below zero. As soon as the trees are well in leaf it ascends to the foliage and begins feeding. oviposition taking place in about 10 days. The eggs which are laid along, and firmly attached to, the projecting larger veins on the under-surface of the leaves, hatch in from 14 to 21 days, the insect, after 4 moults, reaching maturity in 33 to 46 days and females of this first generation beginning to oviposit in 8 days.

None of the insects that prey on this lace-bug can be regarded as efficient natural controls, hence measures must be taken against the adult by means of a contact spray, the eggs being invulnerable owing to the secretion covering them. The best results have been obtained with a fish-oil soap solution used according to the formula, 1 lb. fish-oil soap to 6 U.S. gals. water (preferably soft). This must be applied under a pressure of at least 150 pounds, by means of a large disc nozzle, owing to the difficulty of reaching the insects on the undersides of the leaves. A second application should be made a fortnight later against the young that have hatched out in the meantime.

Experiments with nicotine sulphate, concentrated lime-sulphur and kerosene emulsion, gave unsatisfactory results, the last of these causing severe injury to the foliage.

KNIGHT (H. H.). **New Species of *Lopidea* (Miridae, Hemip.).**—*Entom. News, Philadelphia*, **xxviii, no. 10, December 1917, pp. 455-461,** 5 figs.

The new species of *Lopidea* here recorded from the eastern United States include: *L. heidemanni*, found breeding on elm (*Ulmus*), the nymphs feeding and maturing on the tender terminal growth of young trees, and on yarrow (*Achillea millefolium*), indicating that this species has a wide range of food-plants. It was also taken in considerable numbers on *Solidago rugosa*, in company with *L. media*. *L. salicis* was found only on black willow (*Salix nigra*); *L. reuteri*, found breeding on witch-hazel (*Hamamelis virginiana*); and *L. staphyleae*, on the American bladder nut, *Staphylea trifolia*, where the nymphs feed on the tender foliage during July, the first adults maturing on 18th July and many subsequently migrating to hickory trees in the vicinity.

GIBSON (A.). **A Little Known Cutworm, *Euxoa excellens*, Grt.**—*Canadian Entomologist, London, Ont.*, xlix, no. 12, December 1917, pp. 401–403.

Since the first record of this pest in 1885, *Euxoa excellens* has been abundant in certain years, doing serious damage to various growing vegetables. In 1916 an outbreak was reported and investigated north of Vancouver. The moths are on the wing in British Columbia in late August and September. Nothing definite is known regarding the early life-history of the insect; from present knowledge it would appear that the winter is passed in the egg-stage; possibly during certain seasons hibernation may also occur in the young larval stage. From larvae collected in 1916, the Ichneumonids, *Amblyteles subfuscus*, Cress., and *A. nuncius*, Cress., were reared, while many of the larvae were destroyed by the fungus, *Sorosporella uvella*. Poisoned bran was used with much success, 95 to 100 per cent. of the cutworms being destroyed by this means.

MALLOCH (J. R.). **Key to the Subfamilies of Anthomyiidae.**—*Canadian Entomologist, London, Ont.*, xlix, no. 12, December 1917, pp. 406–408.

The divisions of the subfamilies of ANTHOMYIIDAE adopted by the author differ considerably from those of European authors, and are based upon larval and pupal as well as imaginal characters. Separate keys are given for the sexes. It is hoped to publish keys to the genera of these subfamilies shortly.

ROSS (W. A.). **The Secondary Host of *Myzus cerasi*.**—*Canadian Entomologist, London, Ont.*, xlix, no. 12, December 1917, p. 434.

Recent literature dealing with *Myzus cerasi* (cherry aphis) shows a considerable difference of opinion as to whether this Aphid is migratory, but the observations of the author lead him to believe that this is the case. Apterous forms reside throughout the season on the primary host (cherry) and in addition winged forms produced during the summer migrate to a secondary host and there establish colonies. In Ontario the favourite plant is apparently the wild pepper-grass, *Lepidium apetalum*, to which *M. cerasi* is readily transferred from cherry. No doubt other crucifers serve as summer hosts, and in insectary experiments colonies of *M. cerasi* have been successfully established on *Capsella bursa-pastoris*, *Brassica arvensis* and *Erysimum cheiranthoides*, but these results have not as yet been verified in the field.

VAN ZWALUWENBURG (R. H.). **Insects affecting Coffee in Porto Rico.**—*Jl. Econ. Entom., Concord, N.H.*, x, no. 6, December 1917, pp. 513–517.

Although coffee has been cultivated in Porto Rico for about 150 years, and ranks second in importance only to sugar-cane, little attention has been given to the insects affecting it. The present paper is a summary of the studies of the late Dr. C. W. Hooker, which extended over a number of years, and of the observations of the author.

Leucoptera coffeella, Staint. (coffee leaf-miner), is the most generally distributed pest of coffee, which is its only host-plant, and was probably introduced with the first coffee plants into Porto Rico. Eggs are laid on the upper leaf-surface and hatch in about 5 days. The larva mines in the parenchyma. After about 11 days the fully-grown larva emerges through a hole in the upper surface of the mine and spins its cocoon, usually on the under-side of the leaf, the pupal stage lasting 5 or 6 days. The adult moths are swift nocturnal fliers, hiding under leaves during the daytime; they live from 1 to 4 days. Artificial control of this insect has been as yet unsatisfactory. Nicotine sulphate sprays are partially effective for the larvae, but fail to kill the eggs. Two Chalcid parasites, *Zagrammosoma multilineatum*, Ash., and *Chrysocharis livida*, Ash., destroy this miner in its larval stage, the latter at times being responsible for at least 30 per cent. mortality,

Lachnopus sp. (coffee leaf weevil) is abundant in many plantations, but is not known to occur at elevations less than about 1,000 feet. The adults are found in April and May feeding on the leaves, blossom-buds and newly set berries. The life-history of this weevil has not been ascertained; field observations indicate that the life-cycle occupies one year. Eggs are laid in masses between two overlapped leaves; the larvae upon hatching enter the ground and feed on the roots, but the greatest damage is done by the adults. *Vitex divaricata* is also attacked. A Chalcid has been bred from what appeared to be an egg-cluster of this insect. Shaking the trees and hand-picking during April and May are recommended, but have not yet been tried on a large scale.

Ants are serious pests of coffee in some districts. *Myrmelachista ambigua*, Forel, subsp. *ramulorum*, Wheeler (coffee-shade ant) eats out longitudinal tunnels in which it rears its brood and cultivates colonies of two species of soft scales; when the host-tree is coffee, the scale concerned is a *Pseudococcus*; in most of the trees grown for shading coffee the scale is a fleshy, pink scale representing a new species of *Coccus*. Various poisoned baits have been tried without success; the only possible control seems to be the felling and burning of all infested growth and the planting of temporary shade, such as banana, in which this ant will not form colonies, and replanting of permanent shade trees after several months. This method is expensive and of doubtful permanent value. Another ant, *Wasmannia auropunctata*, Roger, is reported as occasionally killing or displacing colonies of *M. ambigua*, but this little yellow ant is so vicious that pickers refuse to enter areas where it is established.

Minor pests of coffee include the two scales, *Saissetia hemisphaerica*, Targ., and *Howardia biclavis*, Coms., which are both checked by parasitic fungi, the former being particularly heavily parasitised by *Cephalosporium lecanii*. In some localities a Cossid larva, the adult of which has been tentatively determined as *Psychonoctua jamaicensis*, Schs., bores in the main trunk and larger branches, causing a knotty formation in the old wood. Pruning and burning the invaded wood is recommended. *Apate francisca*, F., is another borer with many host-plants that attacks coffee. The larvae can develop only in dead wood. The adults can be killed in the burrows with a piece of stiff wire. *Epicranion championi*, Fowl. (spittle insect), is frequently found around the berry clusters; an external Hymenopterous parasite has been noted,

but did not survive to the adult stage. *Ormenis pygmaea*, F., and the Jassid, *Tettigonia occatoria*, are both common but not seriously injurious. A mealy-bug, provisionally identified as *Pseudococcus adonidum*, L. (*longispinus*, Targ.) is sometimes abundant in the berry clusters. In the spring the Aphid, *Toxoptera aurantii*, Boyer, is very abundant on the new shoots, which it may damage severely. The orange, which is frequently allowed to grow half wild among coffee, is another host-plant of this Aphid. An undetermined Chalcid has been bred from this insect, which is also at times almost completely controlled by the fungus, *Acrostalagmus albus*. Two species of May beetles that attack coffee are probably new and will be described later. While the larvae attack coffee, they are primarily pests of cane. Two Tachinids have been reared from adults of *Lachnosterna* (*Phyllophaga*); one, *Cryptomeigenia aurifacies*, Walt., is fairly abundant, the other, *Eutrixoides jonesi*, Walt., being comparatively rare.

Safro (V. I.). **When does the Cost of Spraying Truck Crops become Prohibitive?**—*Jl. Econ. Entom., Concord, N.H.*, x, no. 6, December 1917, pp. 521–523.

The author discusses the cost of insect control work and points out that while many entomologists, as well as growers, have considered that when the cost of spraying reaches within a fraction of the profit expected, it becomes prohibitive, they forget that the investment itself often represents a much larger amount of money than the season's return. When, for example, some £30 to £35 per acre has been expended in growing onions and a severe epidemic of onion thrips [*Thrips tabaci*] is threatened, it is undoubtedly an economic necessity to spend as much as £10 per acre in spraying to save even £20 of the original investment. The cost of spraying fruit trees in any season, or series of seasons, cannot be worked out as easily on the basis of annual returns as in the case of annual truck crops where the entire business transaction is completed within one year. In the control of pests with a wide range of food-plants it is frequently asserted that the effect of spraying a field would only be temporary and that in several days the field would again be infested by insects migrating from neighbouring weeds and cultivated plants. The author does not consider this to be necessarily true. It is found, for example, after spraying bean fields in Florida against Jassids that the insects reappear after a time; growers have nevertheless found it advisable to spray in order to keep down a sufficient proportion of the insects to allow of plants becoming sufficiently hardy to withstand a severe attack such as would entirely destroy young, untreated ones.

The author discusses the possibility of formulating a rule that would apply eventually to the spraying of both truck crops and fruit trees, and submits the following suggestion for discussion: "The cost of spraying truck crops for pests that threaten to destroy all or a large part of the crop does not become prohibitive until the immediate application in view, together with such following farm operations as can be definitely foreseen, have a total cost in excess of the reasonable expectations of gross returns from the c op in question." There must of necessity be many applications the reason for which cannot be definitely foreseen, resulting in some cases in the cost of spraying

during the entire season exceeding the gross receipts from the crop. It is not always certain whether the destruction of all or a large part of the crop is threatened; in this case the grower should ensure the safety of his crop by considering the destruction as actually threatened.

The author places the problem of parasitism in the same category. Unless parasitism can be definitely foreseen to such an extent as to render spraying unnecessary, the attitude of the grower must be that of the business man who, knowing that the chances of his business being destroyed by fire are remote, nevertheless insures himself against such a contingency as a business necessity. The author purposely omits any discussion of market problems, considering that the contingencies of market values can very rarely be foreseen at the time the grower must deal with his spraying problems and therefore should not affect his efforts in taking care of his crop.

PARKS (T. H.). **A Device for Sowing Grasshopper Poison.**—*Jl. Econ. Entom. Concord, N.H.*, x, no. 6, December 1917, pp. 524–525, 1 plate.

During a grasshopper campaign in Western Kansas in the summer of 1916, an instrument was devised that made it possible to scatter poisoned bran mixture over a much greater acreage than had previously been attempted and is recommended for future grasshopper campaigns. It consists of a canvas bag, waterproof for preference, strapped over the shoulder of the operator and fitted with a feeding device consisting of a canvas sleeve 12 in. long, 13 in. in circumference at the upper end and 8 in. at the lower end, which fits tightly over the end of a swinging tube made of tin or galvanised iron. The tube should be 28 in. long, 2½ in. diameter at the upper end, and 1⅝ in. at the lower end. Over the opening at the lower end, two short wires are bent in the shape of a U, crossing each other at right angles at exactly the centre and about one inch below the opening of the tube, and soldered together where they cross and to the edge of the tube. This causes the mixture to scatter evenly and thinly, and is of the correct dimensions for applying 20 lb. to 4 acres. Oranges and lemons used in the mixture must be ground through a food grinder in order to prevent the tube from becoming stopped by the peelings. It was estimated that 75 to 90 per cent. of the grasshoppers were killed by one application of the poison bran mash scattered by means of this apparatus.

PEMBERTON (C. E.) & WILLARD (H. F.). **New Parasite Cages.**—*Jl. Econ. Entom., Concord, N.H.*, x, no. 6, December 1917, pp. 525–527, 1 plate.

Certain improved cages that were used for confining Braconid parasites of *Ceratitis capitata* (Mediterranean fruit-fly) have given very satisfactory results and are here described. They consist of boxes the bottom and one end of which are of wood, both sides and the other end being of fine copper screening and the top of glass, fitted to slide free from the cage for cleaning. In the wooden end a small opening or door is cut; this is sawed from the piece of wood composing the end of the cage, the cut sides of the door being padded with thin strips of cardboard tightly glued on. The cages used were 7 inches by 3 by 2.

The main point in their construction is that they permit of free air circulation, which is of the utmost importance for general breeding purposes with parasites of the fruit-fly, where moist and often decaying fruit must be placed with them, resulting in the emanation of gases from the fruit and in condensation of moisture on the sides of the cage. Individual lots of parasites have been kept in such cages for nearly two months without need of cleaning or other attention except the renewal of food.

A second type of cage that has been found useful is a straight glass tube 6 to 9 in. long and 1 to 1½ in. in diameter, open at both ends and fitted with copper screen caps just large enough to fit tightly over the ends. This arrangement also permits free air circulation and abundant lighting. These improved cages are most useful in a study of the active life functions of parasites; when it is desired simply to preserve or prolong the life of parasites, the closed test-tube or larger closed sterilising tube is possibly better, as the parasites are best preserved and their energies least expended when given but little food and kept constantly in partial darkness.

Kelly (E. O. G.). **The Biology of *Coelinidea meromyzae*, Forbes.**—*Jl. Econ. Entom., Concord, N.H.*, x, no. 6, December 1917, pp. 527–531.

Coelinidea meromyzae was first reared by Forbes in 1883 from *Meromyza americana* in Illinois. At that time it was concluded that the eggs of the parasite were deposited within the bodies of the host larvae in autumn. In 1908, while observing the habits of *M. americana*, the author of the present paper discovered a small Hymenopteron ovipositing in the eggs of that species and this was later identified as *C. meromyzae*. It was a matter of conjecture how such a large parasite could mature in so small an egg, it being fully four times as large. In the following spring, *Diplazon laetatorius*, F., was observed ovipositing in a similar manner in the eggs of a Syrphid that had been placed among a number of Aphids on chrysanthemum. These Syrphid eggs soon produced Syrphid larvae, which were supplied with Aphids for food; they matured and pupated, but instead of a Syrphid adult there issued an adult of *Diplazon laetatorius*. The author then felt convinced that a similar process occurred in the case of *C. meromyzae*. This parasite was not observed again until 1914, but in that year many wheat plants infested with *M. americana* were placed in breeding cages in the laboratory; from these adults of *M. americana* issued late in the winter, and shortly afterwards adults of *C. meromyzae* began to emerge from the same material. Parasites were introduced among eggs of *M. americana* in the laboratory, and the process of oviposition and development was witnessed. It requires only a few days for the parasitised eggs of *M. americana* to hatch. The larvae mature and reach the pupal stage in about 10 weeks, the adults of both host and parasite maturing in about 12 weeks. Further observation in field and laboratory indicate that adults of host and parasite mature about the same time. The larvae of *M. americana* were dissected and the larvae of *C. meromyzae* were found in them in the fatty tissues, apparently without disturbing the alimentary tract

or interfering with development. The parasitic egg is believed to hatch very shortly after the host's egg and the two larvae develop together, that of *C. meromyzae* not maturing until after *M. americana* pupates; it then feeds voraciously and pupates within the pupal case of the host. The pupal stage of *C. meromyzae* is not more than 8 or 10 days in the laboratory, but probably lasts longer in the field. In the spring adults of both parasite and host are found in the field together; in September *C. meromyzae* appeared two or three weeks later than *M. americana*. The indications are that there are two annual broods of both parasite and host, but it appears probable that under favourable conditions a third generation of *M. americana* occurs, in which case there is also an extra generation of the parasite. *M. americana* has been reported from nearly every State in North America, from Canada to Texas, and the parasite evidently occurs wherever the host is found. From observations in 1914 and 1915, the percentage of parasitism was apparently not sufficient to control the host; it is stated however that this parasite is a sufficient control of the wheat bulb-worm in Illinois and Iowa. This may be universally true, because in localities observed there has not yet been a really serious outbreak of *M. americana*, though it frequently does more or less damage to wheat.

DOZIER (H. L.). **The Life-history of the Okra or Mallow Caterpillar** (*Cosmophila erosa*. **Hübner**).—*Jl. Econ. Entom., Concord, N.H.*, x, no. 6, December 1917, pp. 536–542, 2 plates.

Anomis (*Cosmophila*) *erosa*, Hbn., is principally found in the southern United States, but extends northwards to Massachusetts and Montreal, westward to Kansas and southward through Mexico and the Antilles to South America. The following food-plants in the order of damage done at Gainesville, Florida, are recorded:—Flowering maple (*Abutilon striatum*), okra (*Hibiscus esculentus*), cotton rose (*H. mutabilis*), roselle (*H. sabdariffa*), which is becoming an important commercial plant used in jelly making, Chinese mallow (*H. sinensis*), cotton (*Gossypium* spp.), swamp or rose mallow (*H. moscheutos*) and bell pepper (*Pepperomia* sp.). Hibiscus plants, which are grown commercially, are frequently ruined, and while the damage done to various species of cotton has as yet been negligible, this might not be the case under more favourable conditions.

The eggs are deposited on either surface of the leaves, the lower for preference, and hatch in about 4 days. The larval stage lasts about 24 days, and when mature the larva folds over the edge of a leaf and pupates in the fold. The pupal stage averages six days in July, the length of this stage increasing as the season advances. Pairing takes place soon after emergence and oviposition follows within a few days, the complete life-cycle thus requiring about 34 days.

The most important enemies of *A. erosa* are various predaceous wasps, including *Polistes americanus*. A small Hymenopteron, *Chalcis ovata*, is an occasional parasite. The larvae of the small ground beetle, *Callida decora*, attack and devour the larvae. From eggs of *A. erosa* collected on *Abutilon* several Hymenopterous parasites, *Trichogramma minutum* (*pretiosum*), emerged. Other important enemies are a Pentatomid, *Euthrynchus floridanus*, a Reduviid, *Zelus bilobus*, and other Rhynchota, as well as insectivorous birds.

MARSH (H. O.). **Note on the Life-cycle of the Sugar-beet Webworm.** —*Jl. Econ. Entom., Concord, N.H.*, x, no. 6, December 1917, pp. 543–544.

During 1915 and 1916 details of the life-history and oviposition habits of *Loxostege sticticalis* (sugar-beet webworm), were worked out in detail and the results are given in this paper in the form of tables. The life-cycles of three generations are given; the third generation seldom appears in sufficient numbers to cause appreciable damage. Egg-laying records give an average of 346 eggs for each female, the oviposition period covering a total of 16 days.

HAWLEY (I. M.). **The Hop Redbug (*Paracalocoris hawleyi*, Knight).** —*Jl. Econ. Entom., Concord, N.H.*, x, no. 6, December 1917, pp. 545–552, 1 plate 8 figs.

In June 1913, hop plants in New York State were found to be injured by perforations in the leaves and deformation of the stems. The damage was caused by the nymphs of a recently described species, *Paracalocoris hawleyi*, Knight. Each year since 1913 this bug has increased in numbers and caused greater damage, the plants frequently becoming so weakened that their clinging power is lost and they slip down to the base of the pole. The injury is very similar to that caused by a related species, *Calocoris fulvomaculatus*, De G., to hops in England.

The eggs, which do not hatch until the following spring, are inserted singly or in small groups in the bark or wood of hop-poles in August and September, and hatch throughout the following June. The nymphal period lasts about 30 days, during which the damage is done. Adults appear early in August and do not long survive. Descriptions and illustrations of all the stages are given.

Natural enemies include the Pentatomid, *Apateticus maculiventris*, Say, which is predaceous in both nymphal and adult forms on the immature stages of the redbug. Eggs and nymphs are found on hops in July and August. The Nabid, *Reduviolus subcoleoptratus*, Kirby, and a red mite, *Trombidium* sp., have been found feeding on the nymphs of *P. hawleyi*. Adults of *P. hawleyi* have been found feeding on nymphs of their own species, while the nymphs have been observed devouring the pupa of *Ania limbata*, the larvae of another Geometrid, *Lysia cognataria*, and of the Noctuid, *Hypena humuli*, and the pupa of the Lasiocampid, *Malacosoma americana*.

As a control measure, in July 1915, 1 pint nicotine sulphate with 4 to 6 lb. soap to 100 U.S. gals. water was applied as a contact spray and apparently killed the insect immediately, though $\frac{3}{8}$ pint nicotine sulphate with 4 lb. soap to 100 U.S. gals. water proved ineffective. Spraying should be done about the third week in June, before the plants have produced big branches. Most of the nymphs have hatched and can be easily reached at this time. Poles as well as plants should be drenched, as many nymphs take refuge in the cracks and bark on them. Owing to the activity of these bugs it is advisable to spray from opposite sides at the same time. Winged forms fly before they can be reached by a spray.

Scammell (H. B.). *Amphiscepa bivittata*, Say, **in its Relation to Cranberry.**—*Jl. Econ. Entom., Concord, N.H.*, x, no. 6, December 1917, pp. 552–556, 1 plate.

These notes on the Fulgorid, *Amphiscepa bivittata*, Say, were made in the course of investigations on cranberry insects in New Jersey. Although this species is sometimes present on cranberry bogs in such large numbers as to lead to the conclusion that the bugs are mainly responsible for poor condition of the plants, it is found that as a matter of fact the insect does but little damage, the injuries in most cases being attributable to *Rhabdopterus picipes*, Oliv. (cranberry rootworm), *Crambus hortuellus*, Hb. (cranberry girdler), and *Rhopobota vacciniana*, Pack. (blackhead fireworm). In all cases where the plants were in a vigorous, productive state, *A. bivittata* was rare, and therefore cannot be considered of primary importance as a cranberry pest. Besides cranberry, wild balsam, golden rod and other weeds and herbage, as well as the swamp blueberry (*Vaccinium corymbosum*), all serve as food-plants.

There is only one generation in a year, hibernation occurring in the egg stage. The eggs are laid in living cranberry wood or in pieces of dead wood, in a single row, each egg being inserted separately in the pith of an upright or runner, the opening in the wood being then closed with a tuft of fibre projecting above each slit. On dry bogs hatching begins about mid-May, but the nymphs are few in number until late June or July. There are five nymphal instars, the nymphal period lasting until mid-autumn, during which time the insects suck the juices from the woody parts of the cranberry plants. Adults begin to appear in early August.

A small spider was observed to carry off many nymphs from the breeding-cage, and as spiders are numerous on the bogs they are probably of considerable service in reducing the numbers of the bugs. If infested cranberry bogs could be re-flooded during the summer, the insects could easily be exterminated by applying the water for 24 hours, preferably during cloudy weather about 1st August, when all the nymphs will have hatched and oviposition will not have begun. A slight wind will blow the insects to one shore where they can be killed with a kerosene torch.

Peterson (A.). **Studies on the Morphology and Susceptibility of the Eggs of** *Aphis avenae*, **Fab.,** *Aphis pomi*, **De Geer, and** *Aphis sorbi*, **Kalt.**—*Jl. Econ. Entom., Concord, N.H.*, x, no. 6, December 1917, pp. 556–560.

Observations on the morphological structure of the eggs of *Aphis avenae*, *A. pomi* and *A. sorbi*, and the behaviour of the respective coverings of these eggs during the hatching period shows that they are not hard resistant bodies, but that they go through a critical change previous to hatching, indicating that they are not as resistant during these changes as in the dormant period. The susceptibility of the egg and its lowered resistance near the time of hatching are further shown by various experiments with differences in moisture and in the use of certain contact insecticides and other chemicals. The outer, brittle layer is somewhat impervious to water under ordinary

atmospheric conditions and acts as a protective layer to conserve the moisture content of the embryo; if this outer layer be removed, the eggs shrivel up completely in 24 hours under ordinary atmospheric conditions.

The percentage of eggs of *A. avenae* and *A. pomi* hatching under a constant temperature of 80° F. varies with the moisture content of the air. In dry air up to 4 per cent. of the eggs hatched; in 22 per cent. moisture up to 12 per cent. hatched; in 63 per cent. moisture 20 per cent. hatched; and in 100 per cent. moisture 36 to 46 per cent. hatched. This response to differences in moisture indicates that drought or climates with low humidity probably have an important influence on the percentage of eggs that hatch, and records from various States bear out this conclusion. If this susceptibility in the egg is particularly marked shortly prior to hatching, it would seem probable that certain contact insecticides and chemicals would affect the egg during this period. This has undoubtedly proved to be the case with certain lime-sulphur solutions at winter strength, and crude oil emulsion and other sprays have been successful in killing the Aphids in the egg-stage when applied just before or as the buds were bursting. The exact physical and chemical effect of various sprays on the egg is still not fully understood. The chemical structure of the egg coverings and the nature of the reactions which may occur between the egg and the insecticide used are almost entirely unknown; some of the physical effects produced by various substances have, however, been observed and these are briefly discussed.

In order to kill the insects in the egg-stage, the material used must prevent the nymph from hatching or should kill the nymph as it hatches. Any substance that will harden the outer shell sufficiently to prevent the emergence of the nymphs would be satisfactory. Lime-sulphur apparently does this. A substance that will soften or dissolve the outer layer and expose the pervious, pigmented layer underneath to evaporating factors such as wind, heat or dryness would destroy the eggs; a weak solution of crude carbolic acid apparently has the effect of softening and disintegrating the outer shell. When eggs of *A. pomi* were sprayed with a 2 per cent. solution of crude carbolic acid with enough soap to break the surface tension of water, and placed in a moist chamber, the brittle outer layer became soft and wrinkled in about an hour and could easily be removed. Lime-sulphur and possibly crude carbolic and various other substances have some desiccating effect and probably extract the water content of the ovum or embryo and thus prevent further development. A still more successful ovicide would be a toxic substance that would penetrate the egg coverings and attack the living embryo. The extent of such penetration by various substances is difficult to determine. Another possible means of control would be the discovery of some chemical that would loosen the egg from the twig and cause it to fall to the ground. There is some indication that sodium hydroxide tends to produce this result.

The more successful contact insecticides and various chemicals have been tried on the eggs of all three species. In every case some or all of the eggs proved susceptible to the insecticide used, *A. avenae* being apparently the most susceptible of the three species. A table gives the percentage of eggs destroyed by various substances. Lime-sulphur,

both alone and with nicotine was very successful. Orchard experiments with lime-sulphur, 1 : 9, both alone and combined with Black leaf 40, 1 : 500, gave good results in killing eggs of *A. avenae* and *A. sorbi* when the spray was applied as the buds started to swell ; Scalecide, 1 : 15, applied at the same time did not give a satisfactory result against *A. sorbi.* Carbolic acid and substances containing phenol derivatives give some promise of becoming important agents in the control of Aphid eggs. Crude carbolic acid in strengths up to 5 per cent. acid will not injure young or old apple trees in a dormant condition. Miscible oils containing phenol derivatives show a higher toxic action than those without.

FELT (E. P.). *Asphondylia websteri*, **sp. n.**—*Jl. Econ. Entom., Concord, N.H.*, x, no. 6, December 1917, p. 562.

The alfalfa gall midge, *Asphondylia websteri*, sp. n., which has formerly been treated as identical with the European species, *A. miki*, is here described.

HERMS (W. B.). **The Indian Meal Moth,** *Plodia interpunctella*, **Hübn., in Candy and Notes on Its Life-History.**—*Jl. Econ. Entom., Concord, N.H.*, x, no. 6, December 1917, p. 563.

The larvae of *Plodia interpunctella*, Hb., were found in San Francisco infesting chocolate-coated marshmallow confectionery stored in pasteboard boxes, the eggs evidently having been laid just before packing or before the boxes were closed. Adults were reared from these larvae and the life-history studied. Eggs were laid at night directly on the sweets, and hatched in about two days. The young larvae ate small pits in the sweets and gradually disappeared within, maturing rapidly during a feeding period of some 4 weeks. Fully grown larvae leave the sweets and crawl into corners or crevices where they pass a prepupal period of 9 to 12 days, during which time they spin a crude web in which pupation takes place. The pupal period requires from 10 to 14 days under temperature conditions of 66° to 72° F., or 24 to 28 days under room temperatures of 60° to 68° F. The life-cycle therefore occupies some 40 days at warm temperatures and the insect may be of considerable importance to makers of confectionery.

BENSON (A. H.). **Citrus Culture.**—*Queensland Agric. Jl., Brisbane*, viii, no. 5, November 1917, pp. 253–258.

The great value of spraying in citrus culture is emphasised, especially when carried out thoroughly, at the right time and with the right materials. The usual lead arsenate spray against biting insects, and contact sprays for scale-insects are recommended, a 1 in 40 red oil spray as the insects are hatching being more efficacious than a 1 in 20 when the scales are fully matured. The young scales may also be destroyed with a weak solution of lime-sulphur (1 part standard solution to 30–35 parts water). This remedy is also very valuable for the destruction of spinning and other mites, such as the red spider [*Tetranychus telarius*], the Bryobia mite [*Bryobia pretiosa*] and the Maori mite, which are killed by the fumes of sulphur given off by the spray.

DU BUYSSON (H.). **Observations diverses :** *Cheimatobia brumata*, L.—*Miscellania Entomologica, Narbonne,* xxiv, no. 1, December 1917, pp. 6–7.

For several seasons the winter moth, *Cheimatobia brumata*, has destroyed the apple crop at Veyre and Chanonat, while the caterpillars of *Hyponomeuta euonymellus*, L., also did great damage for a time in the orchards of Montferrand and Gerzat. In the case of *C. brumata* the use of adhesive bands on the tree-trunks at suitable times gave good results, by preventing oviposition and trapping the females.

MERCET (R. G.). **Microhimenópteros de España utiles á la Agricultura.** [Spanish Microhymenoptera beneficial to Agriculture.]—Separate, dated Madrid 1917, from *Asociación Española para el Progreso de las Ciencias, Congreso de Valladolid,* Sección 4ª, pp. 367–377, 7 figs. [Received 3rd January 1918.]

This paper chiefly deals with Chalcids found in the Province of Madrid and was originally read in 1915 before the Spanish Association for the Progress of Science, but as here given it contains additional data collected up to 30th September 1917.

The citrus scale, *Chrysomphalus dictyospermi*, Morg., is attacked by the Aphelinids, *Aphelinus chrysomphali*, Mercet, *Aspidiotiphagus citrinus*, Craw, the Encyrtids, *Aphycus flavus*, Mercet, *Signiphora merceti*, Malen., and the Mymarid, *Parvulinus aurantii*, Mercet (*Paralaptus torquatus*, Malen.), as well as by the Coccinellid, *Chilocorus bipustulatus.*

Lepidosaphes citricola, *L. gloveri* and a species of *Parlatoria* that also infests citrus plants, are parasitised by *Aphelinus mytilaspidis*, Baron, and *A. maculicornis*, Masi.

Lymantria (*Porthetria*) *dispar*, L., is controlled by the Encyrtid, *Schedius kuvanae*, How., the Eupelmid, *Anastatus bifasciatus*, Fonsc., and the Eulophid, *Atoposomoidea ogimae*, How. The olive moth, *Prays oleellus*, and the apple ermine moth, *Hyponomeuta malinellus*, are parasitised by the Encyrtid, *Agenaspis fuscicollis*, Dalm., and by the Elasmid, *Elasmus flabellatus*, Fonsc. *Chionaspis pinifoliae* has a number of enemies in the Province of Madrid, including the Aphelinids, *Prospaltella leucaspidis* and *Azotus pinifoliae*, and the Encyrtids, *Aphycus pinicola*, *Signiphora conjugalis* and *Waterstonia prima.*

The vine moths, *Polychrosis botrana*, Schiff., and *Clysia* (*Conchylis*) *ambiguella*, Hb., are parasitised by *Oophthora semblidis*, Aur., *Elasmus flabellatus*, Fonsc., and *Chalcis pusilla*, Rossi. There are numerous natural enemies of the caterpillars of *Cnethocampa processionea*, *C. pithyocampa* and *Cydia pomonella*, and of the many scale-insects injurious to fruit and other trees. The pear Cecidomyid [*Perrisia pyri*] is attacked by a Proctrotrupid, *Inostemma piricola.*

A list is given of 11 genera of Aphelinids and 30 of Encyrtids at present known in Spain, the former including 26 species and the latter, 77 species. The author intends to publish a monograph on the Encyrtids of Spain, the species recorded being about 200; the total number of species of Chalcids in the Peninsula is believed to be about 2,000.

COOLEY (R. A.). **Fourteenth Annual Report of the State Entomologist of Montana.**—*Montana Agric. Expt. Sta., Bozeman,* Bull. no. 112, December 1916, 76 pp. [Received 2nd January 1918.]

The occurrence of the chief insect pests of 1916 is recorded and the text is given of the Quarantine Proclamation against tbe alfalfa weevil, *Hypera variabilis* (*Phytonomus posticus*), in the State of Utah and parts of the States of Idaho and Wyoming, which came into force in July 1916.

The severe outbreak of the army cutworm [*Euxoa agrestis*] in 1915 afforded opportunity for the study of the life-history and habits of this pest, the results of which have already been noticed [see this *Review*, Ser. A, iv, p. 477]. *Cerodonta femoralis,* Meig. (wheat-sbeatb miner), is a pest widely distributed in tbe State and one which continues in destructive numbers year after year. A recent paper on its life-history and habits has already been noticed [see this *Review,* Ser. A, v, p. 260]. *Pemphigus betae,* Doane (sugar-beet root-louse), has been successfully controlled by irrigation measures [see this *Review,* Ser. A, iii, p. 578]. *Hypera* (*Phytonomus*) *nigrirostris* (lesser clover-leaf weevil), which feeds in the terminal growth and opening blossoms of clover, and the larva of which closely resembles that of the alfalfa weevil, has done damage for two years in a valley in eastern Montana.

BLAKEY (J. G.). **The Mealy Plum Aphis.**—*Gardeners' Chronicle, London,* lxiii, no. 1619, 5th January 1918, pp. 1–2, 5 figs.

The life-history of *Hyalopterus arundinis* (*pruni*) (mealy plum aphis), which is found chiefly on the plum, and which has been believed to migrate to another food-plant, probably reeds or grasses, shows no such migration in the author's experience. The eggs, which are laid singly or in small numbers—up to six—in the axil of a leaf-bud, hatch out early in May, these stem-mothers beginning to produce young 10 days later. The young of the first generation are all wingless females which produce a mixture of winged and wingless forms until towards the end of the season, a large proportion certainly remaining on the plum all the year. In August winged females appear; these are local migrants, *i.e.*, on the same tree, and at the end of August or the beginning of September they produce broods of from 12–20 wingless egg-laying females, only some of which, bowever, appear to be fertile. The eggs remain dormant on the trees for seven months. No males have as yet been discovered by the author.

BROWN (N. E.). **The Defertilisation of Flowers by Insects.**—*Gardeners' Chronicle, London,* lxiii, no. 1619, 5th January 1918, p. 4.

The complete depollination of the flowers of *Pelargonium* by a Syrphid fly is recorded, even the pollen that had already been deposited on the stigmas being removed. The same agency may probably be the cause of the failure to set seed in the case of artificially pollinated plants, such as the South African *Euphorbia gorgonis* experimented upon at the Royal Botanic Gardens, Kew, in 1912.

MUNRO (J. W.). **The Structure and Life-History of *Bracon* sp.: a Study in Parasitism.**—Separate, dated 1st March 1917, from *Proc. R. Soc. Edinburgh 1915–1916*, xxxvi, pt. 3 (no. 20), pp. 313–333, 2 plates. [Received 16th January 1918.]

The first appearance of a Braconid parasitising the larva of *Hylobius abietis* in this country was recorded by the author in 1914 [see this *Review*, Ser. A, ii, p. 661]. The species was then believed to be *Bracon hylobii*, Ratz., but is now thought to be distinct.

Hylobius abietis (pine weevil) is the worst insect pest of forestry in Scotland, attacking and killing newly-formed coniferous plantations, especially those of larch and Scots pine, and occasionally even birch, beech and oak. The adult weevil only is harmful, attacking young trees 3–7 years old during its swarming periods, and reducing or stopping the flow of sap by gnawing the tender bark of stem and branch. Eggs are laid in or under the bark of the stumps of trees that have been recently felled, and the larva feeds, bores and pupates in the bark, thus doing no harm.

The system of forestry now in vogue, by which whole woods are cut down in one felling provides extensive breeding areas for *H. abietis*, while the immediate replanting of the same areas furnishes the weevils on emergence with an abundant food supply.

The species of *Bracon* concerned is not easily studied in the field, owing to a large part of its life being passed in the tunnels of the host, but observations in the laboratory have proved that pairing takes place almost immediately after emergence. The eggs are always deposited on the hard chitin of the dorsal prothoracic surface of the half- or full-grown grub, and not, as previously stated [*loc. cit.*], on those only in the resting stage. The act of oviposition, during which an average of seventeen eggs is laid, causes no inconvenience to the host, which continues feeding for 4–6 days and then passes into a quiescent stage, becoming flaccid, and finally, when the parasite is fully fed, being reduced to an empty sac. The hatching of the eggs takes place within 2–4 days, and the larval period, during which there are five stages, lasts for 6–9 days. The cocoon is spun in the cavity of the bark previously occupied by the host. The period of pupation is 3–6 weeks in summer, and 4–6 months in winter, this long duration being a feature of this Braconid's life-history. This parasite is extremely hardy and can endure any conditions suitable for its host (which, so far as the insects inhabiting Scots pine stumps are concerned, appears to be *H. abietis* only), its distribution coinciding with that of the weevil. So far it has been reported from the eastern counties of Scotland from Ross to Midlothian, as well as from Peebles and Renfrew.

MUNRO (J. W.). **The Genus *Hylastes*, Er., and its Importance in Forestry: a Study in Scolytid Structure and Biology.**—*Proc. R. Physical Soc. Edinburgh*, December 1917, xx, part 3, pp. 123–158, 5 plates, 28 figs.

From the point of view of the forester, the five species of *Hylastes* may be divided into three groups—*H. ater*, Pk., *H. cunicularius*, Er.; *H. palliatus*, Gyll.; and lastly *H. opacus*, Er., and *H. angustatus*, Hbst., both of which are rare.

H. ater is essentially a root-dweller and probably breeds only in the Scots pine, though it feeds on spruce, Douglas fir and perhaps larch in newly-formed plantations, attacking these below the soil level. The favourite breeding-ground of this species is Scots pine clearings, though it may occur on the roots of standing dead or sickly pines in high forests. Pairing may take place in the soil or in the crutch of the brood-gallery and may occur before the beetles, or at any rate the females, are fully mature. The female cuts out a brood-gallery or mother-gallery which begins with a short, transverse, crutch-like portion and is followed by the long straight gallery proper, the male, if present, clearing away the detritus. Oviposition takes place in the dust nibbled by the female from the sides of the tunnel, the eggs being protected by shiny threads that consolidate the frass around them. The eggs hatch in a period varying from a fortnight to three weeks and the newly-hatched larvae start boring at right angles to the mother-gallery. The cutting of the gallery and oviposition extends over a period of six or seven weeks (1st May to 27th June), the average number of eggs per gallery being 120. The duration of the larval stage is eight or nine weeks, six or seven being devoted to feeding and the remainder to resting, while that of the pupal stage is only nine to eleven days, the total period from egg to adult being two to three months.

Harmful beetles associated with *H. ater* are *Hylobius abietis*, L., *Pissodes pini*, L., *Myelophilus piniperda*, L., and *Hylastes palliatus*, the last three being found on the upper parts of the stump, and only rarely on the roots. The following useful predaceous beetles are associated with *H. ater*: *Clerus (Thanasimus) formicarius*, L., a northern insect found in Aberdeenshire and Perthshire but not further south; *Pityophagus ferrugineus*, F., a soil-dweller, also more common in the north; *Rhizophagus dispar*, Pk., an extremely voracious species; *R. ferrugineus*, Pk., and *R. depressus*, F.; *Ips 4-pustulatus*, L.; and *Tachyporus chrysomelinus*, L., found in enormous numbers in a clearing in Aberdeenshire. Hymenopterous parasites include two Braconids and a Chalcid.

The life-history of *H. palliatus* is very similar to that of *H. ater*, except as regards its habitat, *H. palliatus* breeding and feeding above the soil level on the stems and crowns of Scots pine and spruce, and less commonly larch; unlike its congeners, it may begin to feed without leaving its pupal chamber. This species prefers thin bark trees, 30–60 years of age, and being a bast feeder, when it occurs on stumps, it bores from the cut surface directly into the cambium.

Injurious beetles associated with *H. palliatus* are *Myelophilus piniperda*, L., *Pissodes pini*, L., *Pityogenes bidentatus*, Hbst., and *P. quadridentatus*, Htg., which occur on the stems and crowns of Scots pine; *Dryocoetes autographus*, Ratz., and *Trypodendron lineatum*, Ol., on the stems and crowns of spruce; and *Hylobius abietis*, L. Useful insects which associate with *H. palliatus* are the same as those found with *H. ater*, with the exception of *Pityophagus ferrugineus*, F.

The life-history and habits of *H. cunicularius* have already been dealt with [see this *Review*, Ser. A, v, p. 5].

As a forest pest, *H. palliatus* is of less importance than *H. ater* and *H. cunicularius*, since it infests trees at an age when they are better able to overcome attack, and moreover, trees killed by it are still

useful as timber. It prefers trees weakened from various causes, such as the attacks of the pine beetle, *Myelophilus piniperda*, and the lesser pine weevil, *Pissodes pini*. It is best controlled by silvicultural measures, such as the regular thinning of growing woods, cutting out sickly and suppressed stems, the barking of all timber immediately on felling, together with the burning of the bark peeled off. These measures deprive it of its breeding-ground and render it innocuous, while involving no extra work for the forester.

In the case of *H. ater* and *H. cunicularius* such measures are of less value, as they are enemies of the young plantations during the first few years of their existence, and, being root-feeders, measures against them consist of careful planting, and planning of felling and planting. In present-day forestry this, and also the natural regeneration system, involves a strict following of the working plan and precludes extraordinary fellings, having for their aim the prevention of the occurrence of breeding-grounds and feeding-grounds in close proximity. The wide distribution of *H. ater* in Scotland and its present increase are probably due to the extension of felled areas caused by the present drain on the country's timber resources. Special measures against these two species are difficult to devise and costly to carry out. The uprooting of stumps, which is the most effective measure, is costly and leaves the ground littered with stumps, of no market value and difficult to remove, while burning them is equally expensive. Burning brushwood and other litter on the tops of the stumps costs from 30*s.* to £2 per acre, and creosoting them is probably cheaper.

HUIE (L. H.). *Eudemis naevana*, **Hb., the Holly Tortrix Moth.**—*Proc. R. Physical Soc. Edinburgh*, December 1917, xx, part 3, pp. 164–178, 1 plate, 6 tables.

Rhopobota (*Eudemis*) *naevana*, Hb., of which *R.* (*E.*) *geminana*, Stph.—a name given to the form feeding on *Vaccinium*—is a synonym, is a common moth infesting holly trees in England, the lowlands of Scotland and parts of Ireland. Apple and hawthorn have also been recorded as host-plants, but in a garden containing many holly trees they were not attacked, though the larvae were successfully reared on the leaves of both.

The adults emerge at the end of July and the beginning of August, oviposition taking place in August on the under-sides of holly leaves. The larvae, which hatch out the following year at the end of April or beginning of May, begin feeding at once on the young leaves of the opening apical buds, first attacking the outer leaves and working their way inwards. They undergo four moults, and during the third and fourth instars they protect themselves while feeding by fastening the leaves together by a silken webbing, which prevents the unfolding of the buds. The caterpillar is full fed by the end of June or the beginning of July and pupates between two contiguous leaves of a lower branch about a week later, the adults emerging in another 2 or 3 weeks. Injury to the tree consists in the destruction of the growing point, disfigurement due to accumulations of frass, and the distortion of the leaves by rolling and irregular growth.

Experimental control measures were tried against the newly hatched larvae and against those in the first or second instar, by spraying the

foliage with Paris green, lead arsenate, lead chromate and nicotine. These insecticides are arranged in the following order of efficiency :—(1) Nicotine, 10 per cent. of buds remaining infested as against 85 per cent. in unsprayed control trees, while the trees were marked by superiority of growth, the absence of ragged and distorted leaves and freedom from Aphids and spiders; (2) lead arsenate, which affected the appearance of the trees for several months, leaving them with a thin, milky-white coating not easily washed off by rain, while 55 per cent. of the buds became infested; (3) lead chromate, which made yellow patches on the leaves, while 75 per cent. of the buds became infested; (4) Paris green, which had no effect either on the foliage or the pest.

Fumigation of the eggs on a young plant in a chamber with hydrocyanic acid gas at the rate of 1 oz. cyanide to 300 cu. ft. of space had no effect whatever, while another attempt with stronger gas in a space of 12½ cu. ft. killed only 5 out of 14 eggs experimented upon.

MORRIS (H. M.). **On the Larval and Pupal Stages of** *Bibio johannis L.* —*Ann. App. Biol., London*, iv, no. 3, December 1917, pp. 91–109, 1 plate, 12 figs.

Bibio johannis, L., reared from larvae found in the soil of a permanent pasture in Cheshire, is fully dealt with on account of the frequent occurrence of larvae of this family, their possible economic importance, and the absence of any complete account of any Bibionid larva.

Under laboratory conditions the egg hatches in 48 days, and the larva enters the second stage 19 days later. In the field the larvae are usually found not more than half an inch below the surface, among the roots of the pasture grasses, while others are actually on the surface of the soil usually in small colonies. They feed on decaying vegetable matter only, in which the soil of the pasture under consideration was particularly rich, particles of soil and humus being worked into the alimentary canal by slow movement of the mandibles. The larvae have also been recorded from cow-dung, horse-dung, and other situations rich in decaying vegetable matter, such as garden soil and the base of decaying tree stumps, while larvae of this genus can apparently feed on the roots of living plants. No parasites have been met with in connection with this larva, there being only one doubtful record of a Hymenopterous parasite. The larvae are practically unaffected by cold, no deep descent into the soil being made, even in the severest winter. Under laboratory conditions the pupal stage lasted for about 15 days, the second larval stage, in which the insect hibernates, having extended from mid-June till the end of the following March. The adults, on emergence, showed a considerable preponderance of males.

As regards the economic importance of the family, *Dilophus febrilis* and *D. vulgaris* have been recorded as causing damage to the roots of oats, grass, lettuce, seedling cabbage, young flower plants and especially hops; *Bibio marci* feeding on potatoes and damaging tomatoes, young conifers, seedling ash and young spruce; *B. johannis* damaging larch seedlings and hop roots, probably introduced in

manure or leaf-mould; *B. hortulanus* damaging sugar-beet, spring barley and wheat, the latter very severely; *B. abbreviatus* damaging celery plants by burrowing into the stalks, having probably been brought to them in manure; while *B. albipennis* which is very common iu the United States is considered to be harmless.

The larvae may be destroyed by vaporite and injections of carbon bisulphide into the soil, by soil-dressings of soot and lime, or by means of traps consisting of old roots buried in the soil and dug up early in March when the larvae are found feeding on them. Various birds, such as rooks, starlings and chaffinches, as well as domestic poultry, devour the larvae readily. Spraying infested land with a solution of Chile saltpetre in early spring, and harrowing in autumn or early spring after spreading quicklime on the field are recommended, while deep ploughing and rolling at the time of pupatiou have been found satisfactory, contact poisons being said to have little effect.

A bibliography of 31 works is appended.

STEBBING (W. P. D.). **The Locust in Cyprus.**—*Ann. App. Biol., London*, iv, no. 3, December 1917, pp. 119-122.

The small locust, *Dociostaurus maroccanus* (*Stauronotus cruciatus*), is indigenous to Cyprus, where it lives on rocky and poor land, being incapable of long flights. During its larval and hopper stage, it invades cultivated areas and until receutly has beeu au annual plague. The meaus by which it has been checked are:—Egg collection, which is easily carried out as the egg-masses are always laid in light soil bordering the fields; trapping the crawling larvae by trenches on the further side of which are screeus topped with a strip of American cloth; sprinkling the feeding areas with bacteria, causing an epidemic disease, a large supply of this culture being prepared in the Government laboratories. Approaching swarms of locusts may be prevented from settling in vineyards and olive plantations by the beating of tins and the lighting of brushwood fires on the hill tops, while natural enemies such as birds and the lizard, *Agama stellis*, prey upon the adults.

ARROW (G. J.). **The Life-History of *Scymnus capitatus*, F.**—*Entomologists' Mthly. Mag., London*, liv, no. 644, January 1918, pp. 8-9.

The widely distributed genus *Scymnus* is represented in Eugland by fourteen species, of which one, *S. capitatus*, has receutly been found at Tooting in the larval stage, preying upon *Phylloxera* on infested oaks, in company with the predaceous Neuropteron, *Conwentzia psociformis*. The larval and pupal stages of *S. capitatus* are here described in detail.

BUTLER (E. A.). **Note on *Coranus subapterus*, De G.**—*Entomologists' Mthly. Mag., London*, liv, no. 644, January 1918, pp. 16-17.

A female of the Reduviid bug, *Coranus subapterus*, fed in captivity upon Aphids and Lepidopterous larvae, was found to be capable of killing a young caterpillar of *Diacrisia* (*Spilosoma*) *lubricipeda*, quite as large as itself.

HARRISON (J. W. H.). **Additional Localities for *Eriococcus devoniensis*, Green.**—*Entomologists' Mthly. Mag., London,* liv, no. 644, January 1918, p. 17.

This Coccid which has been recorded previously from Devon, Surrey, Cheshire, Durham and Yorkshire is reported as occurring in extreme abundance on every Cleveland moor visited, as well as on the fells on the Northumberland-Cumberland border, and in the far west of Durham on *Erica tetralix,* far from its lowland habitat.

Yorkshire Naturalists' Union: Entomological Section.—*Entomologists' Mthly. Mag., London,* liv, no. 644, January 1918, p. 21.

The destruction of acres of white turnip near Wakefield by the larvae of *Euxoa (Agrotis) segetum,* Schiff., is reported by Mr. Hooper. Mr. Morley commented on the swarms of *Charaeas graminis,* L. [see this *Review,* Ser. A, v, pp. 478, 481] in August on both moors and lowland pastures, these larvae having been such a pest in South-west Yorkshire, that at Penistone the town-roller was mobilised to deal with the invasion.

TREHERNE (R. C.). **Every Farmer his own Entomologist.**—*Agric. Jl., Victoria, B.C.,* ii, no. 8, October 1917, pp. 149 & 157. [Received 9th January 1918.]

Although much has been done to help farmers in their campaign against insect pests, by the publication of spray calendars and of information regarding the life-histories of the chief economic insects, yet most valuable help might be obtained by each farmer in studying such common pests as *Epochra canadensis* (currant fruit fly). By collecting and burying injured fruit in the spring, erecting a closed lantern chimney over the spot and watching the emergence, it would be possible to ascertain exactly when to apply the poison-bait spray, in each individual case. Similarly the common and widely distributed *Lepidosaphes ulmi* (oyster scale) could be sprayed for most efficiently if the farmer were able to ascertain the time of hatching by the first appearance of young scales upon the bark. Insects that emerge from the soil in the early spring, such as pear-thrips [*Taeniothrips inconsequens*], could be controlled if their emergence were observed in small cheese-cloth cages erected on the orchard soil. In the same way in the case of the cabbage-root maggot [*Chortophila brassicae*], the best time for applying mixtures to the roots or erecting cheese-cloth screens over the early radish crops could be determined by burying a few maggots from autumn cauliflowers in 2 or 3 inches of soil, and noting the date of emergence of the flies in spring. Insects that winter above ground on twigs or branches may be kept under observation by bagging the twigs with cheese-cloth.

HARLAND (S. C.). **Special Entomological Investigations.**—*Rept. Agric. Dept. St. Vincent for 1916–17, Barbados,* 1917, pp. 10–11. [Received 9th January 1918.]

The larva of a moth, *Ballovia cistipennis,* a new pest of cowpeas, has appeared in St. Vincent, having been previously recorded from Barbados. The eggs are laid at the top of the flower-stalk or in the

calyx of the bud, and hatch out in 2 or 3 days, the larvae immediately boring into the tissues, which they leave after 8 or 9 days to pupate in the soil, whence the moth emerges in about a week. Owing to the part attacked being the flower-buds or young pods, the damage done by this pest is considerable. No larval or pupal parasites have been reared, though *Trichogramma minutum* is known to parasitise the eggs. Other food-plants are *Canavalia* spp. and a wild plant, *Vigna luteola*.

The following identifications of insects reared in 1915–16 have been made:—Lepidoptera: *Nacoleia indicata*, F. (lima-bean worm), on *Phaseolus* spp.; *Pachyzancla bipunctalis*, F., on *Amarantous*, spp.: and *Tischeria* sp., a leaf-miner, in *Synedrella nodiflora*. Diptera: *Agromyza inaequalis*, Mall. (lima-bean blotch-miner), on lima bean; *A. parvicornis*, Lw. (corn-leaf blotch-miner), on maize; and a new species of *Agromyza* mining in *Commelina virginica*.

Parasites reared in 1915–16 have been determined as follows:—The Tachinids, *Eucelatoria australis*, Towns., and *Sarcodexia sternodontis*, Towns., larval parasites of *Calpodes ethlius*; the Chalcids, *Chrysocharodes majoriam*, Gir., a pupal parasite of a leaf-miner on cassia (*Commelina virginica*); *Achrysocharella aetii*, Gir., a pupal parasite of a leaf-miner on *Synedrella nodiflora*; *Polycystus clypeatus*, Gir., a pupal parasite of *Agromyza parvicornis*, Lw.; *Pseudomphale eudami*, Gir., and *Grotiusomyia eudami*, Gir., larval parasites of *Eudamus proteus*; *Habrolepoidea submetallica*, How., an egg-parasite of *Nezara viridula*; *Tetrastichus fasciatus*, Ashm., a larval parasite of *Cecidomyia manihot*, Felt; and *Neocatolaccus syrphidis*, Gir., a pupal parasite of a Syrphid fly that attacks the corn aphis [*Aphis maidis*].

Work connected with Insect and Fungus Pests and their Control.—*Rept. Agric. Dept. St. Vincent for 1916–17*; *Barbados*, 1917, pp. 11–15. [Received 9th January 1918.]

The subject matter of this report has already been noticed from another source [see this *Review*, Ser. A, v, p. 580].

Ross (W. A.). **The Black Cherry Aphis.**—*Canadian Horticulturist, Toronto*, xl, no. 12, December 1917, pp. 307–309.

An outbreak of cherry aphis [*Myzus cerasi*] was reported from the Niagara district during the summer of 1915, the fruit being so badly damaged that most of it was left on the trees. The attack of this pest causes infested leaves to become tightly curled, and to turn brown and die, while the stunted fruit is covered with honey-dew in which a black fungus thrives.

The minute, oval, black eggs are deposited round the buds and on the rough bark of twigs and branches in the autumn. They hatch early in spring, and the nymphs first attack the leaf-buds and later on the young leaves and flower-buds. In about a month they begin to produce brood after brood of wingless and winged females until the autumn, the winged forms from mid-June to mid-August migrating to wild pepper-grass, where they establish summer colonies of wingless individuals [see this *Review*, Ser. A, vi, p. 103]. In early autumn these produce migrant forms that return to the cherry and produce egg-laying females, while at the same time the wingless forms on the cherry produce

large numbers of winged Aphids which also give rise to egg-laying females. Early in October winged males appear on the wild peppergrass and migrating to the cherry mate with the females.

The best remedy is thorough spraying with Black leaf 40 early in spring as soon as all the eggs have hatched, when it is most economically applied in combination with the delayed lime-sulphur dormant spray.

GIBSON (A.). **Control of the Onion Maggot.**—*Canadian Horticulturist, Toronto,* xl, no. 12, December 1917, p. 312.

The control of the imported onion maggot, *Hylemyia antiqua*, has proved a difficult problem under field conditions, owing to the prohibitive cost of such insecticides as hellebore, insect powder and carbolic wash. During the last two seasons satisfactory tests have been made with a poisoned bait spray composed of sodium arsenite $\frac{1}{4}$ oz., molasses 1 pint, boiling water 1 gal.; the sodium arsenite is first dissolved in the boiling water and the molasses added, the mixture being ready for use when cool. Five applications of this were made between 13th June and 16th July, the plants being about a foot high on the latter date. The mixture was applied with a watering-can with a small rose, the cost working out at a little less than five shillings an acre, for ingredients and labour, and the time occupied being less than ten minutes an acre.

SWAINE (J. M.). **The False Tussock Caterpillars on Shade Trees.**—*Agric. Gaz. Canada, Ottawa,* iv, no. 12, December 1917, pp. 1043–1047.

During the summer of 1917 a serious outbreak of defoliating caterpillars occurred on the shade trees of Eastern Canada, the most abundant and widely distributed species being the false tussock caterpillars.

These included the hickory tussock moth, *Halisidota caryae*, Harr., which lays its eggs to the number of about 100 in a patch on the under-side of a leaf during early summer, its chief food-plants being hickory, walnut, elm, butternut, hawthorn, rose, apple, ash, linden, oak and locust The conspicuous black and white caterpillars feed gregariously at first, defoliating whole branches during the latter part of July, August and early September. They then pupate in oval, hairy, greyish cocoons, from which the moth emerges the following June. *H. maculata*, Harr. (spotted tussock) is a very similar species, the larvae of which feed on alder, apple, willow, and Manitoba maple, although it is usually recorded from the Eastern States as feeding on oak. It rarely occurs in sufficient numbers to cause serious injury or require control. *H. tesselaris*, S. & A., is another similar species, the larvae feeding on many native trees and shrubs.

These caterpillars may be easily controlled by spraying the infested foliage with lead arsenate or Paris green, the lead arsenate being used at the rate of $2\frac{1}{2}$ lb. paste to 40 gals. water, or $1\frac{1}{4}$ lb. powdered lead arsenate to the same quantity of water, while Paris green is employed at the rate of 5 oz., mixed with 1 lb. freshly slaked lime, in 40 gals. of water. They are heavily parasitised, especially by the common

Ichneumon, *Scambus pedalis*, Cress., as well as by *Theronia melanocephala*, Brull., and *Amblyteles malacus*, Say, which fact prevents their attaining the rank of important shade tree pests.

FLETCHER (T. B.). **Report of the Imperial Entomologist.**—*Scientific Reports Agric. Research Institute, Pusa, for 1916–17; Calcutta,* 1917, pp. 71–90. [Received 14th January 1918.]

Experimental work on insect pests was continued, and parasites of the cotton bollworm, *Earias* spp., were bred and despatched to the Punjab, being identified as belonging to the genus *Microbracon*. The life-history of *Nephotettix bipunctatus* (rice leaf-hopper) was worked out. Investigations on the different species of borers attacking sugar-cane, maize, *Sorghum vulgare* (juar) and rice have resulted in the following determinations:—*Chilo simplex*, found in maize, sorghum and rice; *Diatraea suppressalis* (*auricilia*), chiefly in sugar-cane, a few examples being found in sorghum, but not in maize; *Diatraea venosata* (*striatalis*), found in sugar-cane and a thick variety of sorghum, and none in maize; an unidentified species of *Diatraea* fouud in sugar-cane only. All the above have hitherto been recorded as *Chilo simplex*. In addition there are:—*Papua depressella*, the most injurious of all borers to young sugar-canes, its activities, however, decreasing with the growth of the cane; *Scirpophaga xanthogastrella* (*auriflua*), one of the first borers to attack cane; *Sesamia inferens*, known to occur in maize, sorghum, sugar-cane, rice and several other members of the Graminaceae.

Observations made month by month of the damage due to insects and red rot on experimental plots of thick, medium and thin canes respectively has led to the conclusion that red rot causes a high percentage of damage, that a thick variety (Purple Mauritius) is more liable to attack than other varieties, the amount of damage due to insects in June being greater than in any of the other plots, even though all affected plants had been cut out in April and again in May; and that *Scirpophaga* will prove to be the only insect amenable to the treatment by cutting out affected shoots.

Other insects observed for the first time feeding underground among sugar-cane roots were the larvae of the Dynastids, *Alissonotum piceum* and *A. simile*, and of the weevil, *Myllocerus blandus*. An undetermined Melolonthid grub, probably *Anomala* sp., has been observed killing young shoots by gnawing into the stems from the side, and larvae of *Myllocerus discolor* have been found commonly among the roots. Further observations have confirmed the view that termites damage sugar-cane shoots and setts only in certain kinds of soil. These may be protected by dipping in a solution of 1 lb. lead arsenate in 2 gals. water, while a strength of 1 lb. in 1 gal. had no harmful effects on germination, and weaker solutions up to 1 lb. in 4 gals. were also effective.

In the insectary more than 200 different lots of insects were reared, most of them for the first time. Among those that may rank as serious pests are Cerambycid borers of Sann hemp and *Phaseolus aconitifolius*, and *Anobium* sp. in stored cumin seeds and aniseed.

Investigations were made into the life-histories and habits of the pea-stem fly, which was found to damage only plants growing alone

or thinly; *Eugnamptus marginatus*, the adult weevil being most active on mango trees in July and August and the grubs resting in the soil from September to March and April; *Attagenus piceus*, the life-cycle of which takes from 1-3 years to complete; *Melittia eurytion*, the caterpillar of which bores and causes a swelling in the stem of *Trichosanthes dioica* and other Cucurbitaceous plants in the rains, and passes the rest of the year in the larval stage inside a very stiff cocoon; *Cosmopteryx manipularis*, a Lepidopterous miner in bean leaves, which rests in the larval stage from about November to July; a Eurytomid grub in apricot seed, which probably rests inside the seed for two years in some cases, though most individuals emerge as adults after one year; an Elaterid beetle, *Agrypnus fuscipes*, the life-cycle of which seems to take 3 to 4 years; *Ancylolomia chrysographella*, which has several broods, each cycle taking about a month and hibernating in the caterpillar stage from November till March or April; *Aspongopus brunneus*, a bug which causes severe damage to pumpkin plants; *Massepha absolutalis*, a Pyralid rolling bamboo leaves, which rests in the larval stage in winter; *Pempheres affinis* (cotton-stem weevil), which has been found to breed in a new food-plant, *Triumfetta* sp., one of the Tiliaceae; and *Lampides* (*Polyommatus*) *baetica*, which is a pest of the flowers of *Butea frondosa*.

Grain storage experiments showed that *Rhizopertha dominica* cannot breed where the air has free access, but under close storage conditions it can do much more damage to wheat and in a shorter time than *Calandra oryzae*. Loss due to the latter may be reduced to a minimum by frequently exposing the grain to air and light when practicable. Based on this, a new method of outdoor storage in granaries made entirely of straw is being tested, as is also the method of storage under sand. Keeping the seeds covered with sand, coarse or fine, has given the best results against *Bruchus chinensis*, which breeds in the larger varieties of peas, *Pisum sativum*, *Cajanus indicus*, lentils, *Lathyrus sativus*, *Phaseolus radiatus* and *P. mungo*, *Vigna catjang*, and *Vicia faba*, causing serious damage. The small pea, *Pisum arvense*, is not injured by this pest when stored, but in the field it is infested by *B. affinis*. *Tribolium castaneum* is commonly associated with *Rhizopertha dominica* in stored wheat and rice, as is also *Tenebroides mauritanicus* with *Calandra oryzae*, on which weevils the adult beetles prey. The expectation that this insect might therefore exercise a natural control has not been fulfilled, since the adults appear and oviposit in July-August, passing the rest of the year in the larval stage. During this time they do not attack the weevils, but bore into wheat and rice grains, the chief damage by the weevils occurring simultaneously, while at other times they do not occur in sufficient numbers to act as a check.

Bagrada picta in an experimental plot of mustard was entirely checked by spraying with fish-oil resin soap at a strength of 1 lb. in 4 gals. water, which killed even the adult bugs. Research with the object of finding insects which could be utilised as checks on the growth of *Lantana* indicated three possible ones, viz.:—*Platyptilia pusillidactyla*, already widely distributed in India and Burma, being one of the insects imported from Mexico into Hawaii; an apparently new Eucosmid moth; and a Cecidomyiid fly.

Hutchinson (C. M.). **Report of the Imperial Agricultural Bacteriologist.**—*Scientific Reports Agric. Research Institute, Pusa, for 1916-17*; *Calcutta*, 1917, pp. 103-118. [Received 14th January 1918.]

Since a more complete knowledge of the life-history of *Nosema bombycis* and of the reciprocal relationship between this parasite and its host are necessary for the control of pebrine among silkworms, experimental research on the points of hereditary infection and infection through contagion or ingestion of the parasite have been carried out with the following results:—Infected eggs have been found to produce silkworms that succeed in reaching the cocoon stage, provided that sufficient space and suitable food are available. Such individuals, however, cannot be used for breeding purposes as the resistance acquired through suitable environment is only sufficient to hold in check the multiplication and spread of the parasite. The principal, if not the only means of infection, other than by hereditary transmission, has been proved to be by ingestion of the parasite spores with the food, these being present in great numbers in the dust of rearing houses. They also may be excreted by infected but still feeding individuals, which in this way infect the leaves of the food-plant. Infection, once introduced, spreads rapidly through the dissemination of the spores by human beings, insects and dust, not only in the same house but also to neighbouring rearing houses. Cocoons and eggs received from a distance, though hereditarily free from the disease, may be contaminated during examination in an infected house, owing to faulty technique, which results in the accumulation of infective material in the building. Of the action of antiseptic insecticides in rearing houses little at present is known, attention having been directed towards the determination of the viability or persistence of infective power of the pebrine spore under varying natural conditions. It has been found that desiccation for six months did not destroy the infective power of the spores, whereas they were rendered innocuous in a month by moderate moisture at the same temperature. The stimulus determining the generation of the spore is apparently the combination of moisture and suitable temperature found in the gut of the silkworm, and it is probable that the deleterious effects of continued moisture upon the vitality of the non-ingested spore are due to prematurely induced development, not carried so far as germination, but resulting in either partial or total loss of vitality. Further investigation is necessary regarding the effect of climate or manurial treatment upon the nutritional value of the mulberry leaf, together with the resulting reaction upon the resistance of the silkworm to infection.

Anstead (R. D.). **A Swarm of Insects.**—*Planters' Chronicle, Bangalore*, xii, no. 47, 24th November 1917, p. 594. [Received 12th January 1918.]

A remarkable swarm of insects is reported to have occurred last July on a coffee plantation situated on the leeward side of a hill, its effect being similar to that of a cyclone, shade trees having their branches bent and broken by the weight of the insects, while the coffee was covered, though to a less degree. The insect has been identified as a Pentatomid bug, *Ochrophora montana*, which however only did

mechanical damage. Since it has been calculated that it takes 1,000 of these insects to weigh an ounce, the number present must have been enormous.

SOUTH (F. W.). **Summary of Locust Work for the 4th Quarter, 1916.** —*Agric. Bull. Fed. Malay States, Kuala Lumpur,* vi, no. 1, October 1917, pp. 21–37. [Received 12th January 1918.]

Measures against locusts for the third quarter were not concluded in the Negri Sembilan, Pahang, Malacca and Johore districts till the end of October, and the reappearance of hoppers early in November necessitated a resumption of the work, which was not entirely finished by the end of the year, though a successful result was anticipated.

The year's locust work in the Peninsula may be regarded as quite satisfactory, though there were unexpectedly large generations of hoppers from March to May, probably the offspring of unknown swarms from remote places. An even larger generation or succession of generations followed from July to the end of October, but as only a few of these swarms escaped there was a considerably smaller generation at the end of the year, the destruction of all the known swarms in the Negri Sembilan and Malacca being probable by the end of January. In all 2,911 swarms were destroyed in the Negri Sembilan, 158 in Pahang, 4,952 in Malacca, and 1,877 in Johore during the year, the position for 1917 appearing to be favourable, as most of the remote possible breeding grounds are now known.

HENRY (G. M.). **Insect Pests of Food Crops.**—*Trop. Agriculturist, Peradeniya,* xlix, no. 5, November 1917, pp. 252–255.

This paper contains a list of the common pests of vegetables in Ceylon and gives general recommendations for the control of each class of insects dealt with.

HUTSON (J. C.). **The Pink Boll Worm.**—*Agric. News, Barbados,* xvi, no. 407, 1st December 1917, p. 378.

In this article the great danger threatening the West Indian cotton industry should *Pectinophora gossypiella* (pink bollworm) ever be introduced into the islands is emphasised. Realising this, the authorities of the Leeward and Windward Is. and those of Tobago and Trinidad have framed stringent quarantine regulations; these have not yet been adopted by Barbados, though it is hoped that in the near future similar action will be taken there.

MUMFORD (F. B.). **How the Station Works.**—*Missouri Agric. Expt. Sta., Columbia,* Bull. no. 151, September 1917, 68 pp. [Received 14th January 1918.]

In the entomological section investigations were carried out on the life-history, distribution, injury, and methods of control of insects injurious to nursery stock, especially the apple-leaf skeletoniser [*Canarsia hammondi*]. Experiments showed that hydrocyanic acid gas destroyed 97–98 per cent. of living scale-insects on nursery stock, while miscible oil destroyed 99–100 per cent.

Experimental control measures against insect pests of melon and related crops have shown that the striped cucumber beetle [*Diabrotica vittata*] can be successfully controlled by dust and sprays. Nicotine killed the young nymphs of the squash stink bug [*Anasa tristis*], but merely stupefied the adults. The only effective remedy for the squash vine borer, *Melittia satyriniformis*, is the collection of the larvae by hand. A new unidentified bug has been observed late in autumn on squash foliage.

Investigations on the annual cycle of Hessian fly [*Mayetiola destructor*] have shown that wheat sown on and after the calculated fly-free date is not attacked. Consequently, in practice, the best method is to plough in the stubble and keep the land in cultivation so as to prevent the growth of self-sown wheat, until the crop can be sown after the fly-free date.

SEDLACZEK (—). **Relation between Climate and Life-Cycle of the Tussock Moth** (*Lymantria* (*Liparis*) *monacha*).—*Mthly. Bull. Agric. Intell. and Pl. Dis., Rome*, viii, no. 8, August 1917, p. 1200. (Abstract from *Oesterreichische Forst- und Jagdzeitung, Vienna*, Year xxxiv, no. 44, 1916, pp. 259–260). [Received 17th January 1918.]

From observations on *Lymantria monacha* during the period 1906–1915, the author has drawn the conclusion that this moth requires for its post-embryonic development a sum-temperature of 2,732° F., the moths only appearing in any great numbers in any place when this aggregate daily temperature has been reached. The earlier, therefore, the necessary sum-temperature is obtained, the greater the time the moth has at its disposal for flying. The nuptial flights take place on fine, windless evenings when the temperature is above 58° F. After years with 12 evenings favourable to flight, the moth has multiplied to a much greater extent in those with a smaller number; this explains why it does not breed to any very great extent in the mountains.

FULLAWAY (D. T.). **Division of Entomology.**—*Hawaiian Forester & Agriculturist, Honolulu*, xiv, no. 11, November 1917, pp. 323–324. [Received 19th January 1918.]

During the month of October the insectary handled 27,400 pupae of the melon fly [*Dacus cucurbitae*], from which 1,207 individuals of *Opius fletcheri* were bred and distributed. The following parasites were also distributed:—*Diachasma fullawayi*, 90; *D. tryoni* 340; *Tetrastichus*, 200; *Paranagrus* (corn leaf-hopper parasite), 2,650.

EHRHORN (E. M.). **Division of Plant Inspection.**—*Hawaiian Forester & Agriculturist, Honolulu*, xiv, no. 11, November 1917, pp. 324–326. [Received 19th January 1918.]

During October a box of pears from California heavily infested with the codling moth [*Cydia pomonella*] was destroyed. Coconuts from Fanning Island were fumigated before delivery, being infested with the scale, *Aspidiotus destructor*. Several packages of beneficial insects were imported from Manila.

ADERS (W. M.). **Entomology in Relation to Agriculture.**—*Zanzibar Protectorate Med. & Pub. Health Repts. for 1915*; *Zanzibar*, 1916, pp 49–51.

Insect pests did not cause any serious outbreak in the year under review, but those recorded in previous years occurred more or less throughout the season [see this *Review*, Ser. A, iii, p. 124].

The most prevalent pests of citrus trees are various Coccids, of which the following have been identified :—*Icerya seychellarum, I. purchasi, Pseudococcus citri, Coccus* (*Lecanium*) *viridis, Pseudaonidia* (*Aspidiotus*) *trilobitiformis, Lepidosaphes beckii* (*citricola*) and *Dactylopius obtusus.* Spraying with fish-oil has given fairly good results, especially on young trees.

Insects injuring economic plants during the year include :—Diptera : Larvae of *Dacus brevistylus*, Bezzi, *D. vertebratus*, Bezzi, and *D. punctatifrons*, Karsch, in Cucurbitaceae ; *Ceratitis rosa*, Karsch, bred from soursop. Lepidoptera : *Chilo suppressalis*, Wlk., the larvae of which feed on maize cobs and tunnel in the main stalk ; *Duomitus capensis*, Baker, the larvae tunnelling in castor-oil plants ; *Miresa melanosticta*, Baker, the larvae of which are found abundantly feeding on leaves of *Terminalia catappa* (African almond). Coleoptera : *Tenebroides mauritanicus*, L., in various stored grains ; *Cossonus suturalis*, Boh., in stored sweet potato tubers ; *Necrobia rufipes*, de G., adults and larvae of which feed on stored copra, causing considerable damage. A list of the Coccids infesting various trees is given.

SPEYER (E. R.). **Agricultural Investigations in Ceylon.**—*Trop. Agriculturist, Peradeniya*, xlviii, no. 6, June 1917, pp. 347–348.

Egg parasites of the tea tortrix [*Homona coffearia*] have been studied and bred successfully in the laboratory and this work is being continued under more natural conditions in Maskeliya. *Icerya purchasi* (fluted scale) is increasing in spite of predatory Coccinellids and the fungus, *Cephalosporium.* For the control of *Xyleborus fornicatus* (shot-hole borer of tea) an experiment has been tried of pruning infested bushes in order to anticipate a severe attack ; this did not prove successful from the economic point of view, but the results prove that the prescribed periods when extra prunings should take place are entirely correct. It is important that all woody portions of prunings should be burnt immediately after pruning. Experiments with washes have been continued and a partly satisfactory paint composed of fish-oil and resin has been obtained ; these investigations will be completed during the next pruning season. *X. fornicatus* has been found for the first time in the dead-wood of the Ceylon almond, *Terminalia.* This discovery is important, as it is the first indication of the possibility of using a successful trap. Several other Scolytids have been found and received from dead rubber trees and from *Grevillea, Albizzia* and *Tephrosia.*

SPEYER (E. R.). **The Fluted Scale** (*Icerya purchasi*).—*Trop. Agriculturist, Peradeniya*, xlviii, no. 6, June 1917, pp. 355–358, 1 fig.

Icerya purchasi (fluted scale) was first discovered in Ceylon in 1915 on *Acacia decurrens* and later on *Casuarina* trees. By August 1916

it had increased enormously on *Acacia*. The chances of natural extermination of the scale are small, while the spread of infestation to certain agricultural crops in Ceylon would be disastrous. An appeal is made to all agriculturists to co-operate in providing information regarding the spread of this pest and to attempt its control before it attacks economic products. Immediate steps should be taken to have all infested material cut out and burnt.

ANSTEAD (R. D.). **Coffee Borer in Indo-China.**—*Planters' Chronicle, Bangalore*, xii, no. 48, 1st December 1917. p. 608.

The coffee borer [*Zeuzera coffeae*] is a serious pest in the coffee plantations of North Annam, where 12 or 13 per cent. of the trees, if not more, are attacked by it every year. As the larva of this moth attacks the root as well as the branches, cutting down the bushes is useless unless the stumps are also removed; consequently plantations always show gaps that must be replanted with vigorous nursery stock. The insect begins its attack on the bushes in the third year from planting.

SCHWARZ (E. A.). **Ants protecting Acacia Trees in Central America.**—*Proc. Entom. Soc. Washington, Baltimore, Md.*, xviii, no. 4, December 1916, pp. 211–212.

Ants of the genus *Pseudomyrma* living in the thorns of acacias in Mexico and Central America effectually defend these trees against the attacks of man, cattle, and insects, such as leaf-eating caterpillars and ants, Aphids and Coccids, though one Coleopteron, a species of *Bruchus*, oviposits in the acacia pods without being molested. The stingless wasp, *Polybia occidentalis*, Oliv., also builds its nest in the tops of these ant-protected trees and nowhere else. The ants are powerless to protect their host-plant against underground boring larvae; among those bred from a tree killed in this way were seven species of CERAMBYCIDAE and one Buprestid, a species of *Agrilus*.

FISHER (W. S.). **A New Species of *Xylotrechus* (Coleoptera: Cerambycidae).**—*Proc. Entom. Soc. Washington, Baltimore, Md.*, xviii, no. 4, December 1916, pp. 214–216.

Xylotrechus aceris, sp. n., is here described; this species has been confused with *X. quadrimaculatus*, to which it is closely allied, but from which it differs in its habit of making galls on maple trees, being recorded from *Acer rubrum* (red maple) and *A. platanoides* (Norway maple). The injury caused by *X. quadrimaculatus* consists in girdling the branches of various trees.

GIBSON (A.). **The Occurrence of *Eumerus strigatus*, Flu., in Canada.**—*Canadian Entomologist, London, Ont.*, xlix, no. 6, June 1917, pp. 190–191.

The European Syrphid, *Eumerus strigatus*, has been recorded as a pest of onions, shallot, iris, narcissus, hyacinth and amaryllis. It is now widely distributed in North America, where its presence was first recorded in 1904. As many as 17 larvae, which measure half an inch or more when full grown, have been found in a single bulb, their occurrence being the cause of much loss.

GILLETTE (C. P.). **Two New Aphid Genera and some New Species.**—*Canadian Entomologist, London, Ont.*, xlix, no. 6, June 1917, pp. 193–199, 1 plate.

A new genus, *Thripsaphis*, with *T. ballii*, Gill., as the type, is erected in this paper. This Aphid is generically distinct from *Saltusaphis*, Theo., in which it was formerly included. The males, so far as known, are apterous and very small, and the females secrete waxy threads with which they cover their eggs. *T. verrucosa*, sp. n., is a closely allied form, and *T. producta*, sp. n., is the most abundant species in Colorado, occurring upon *Carex*. Another new genus, *Aspidaphis*, is represented by *A. polygoni*, sp. n., first taken on *Polygonum* sp. (knot-grass or door-weed) in Colorado. It closely resembles the colour of the under-side of the leaves and of the stems of the different species of *Polygonum*, which are its sole food-plants.

GIBSON (E. H.). **Two New Species of *Dicyphus* from Porto Rico, (Miridae, Heteroptera).**—*Canadian Entomologist, London, Ont.*, xlix, no. 6, June 1917, pp. 218–219.

Two Capsid bugs, *Dicyphus prasinus*, sp. n., and *D. luridus*, sp. n., that have proved injurious to tobacco plants in Porto Rico are here described.

FISHER (W. S.). **A New Species of *Agrilus* from California.**—*Canadian Entomologist, London, Ont.*, xlix, no. 8, August 1917, pp. 287–289.

A description is given of *Agrilus burkei*, sp. n., which has been confused with *A. politus*, Say, to which it is closely allied, but from which it differs chiefly in colour and habits. The larvae mine in the inner bark and wood of normal, injured, and dying white alder (*Alnus rhombifolia*), and paper-leaf alder (*A. tenuifolia*).

DICKERSON (E. L.). **Notes on *Leptobyrsa rhododendri*, Horv.**—*Jl. New York Entom. Soc., Lancaster, Pa*, xxv, no. 2, June 1917, pp. 105–112.

An account is given of the life-history of *Leptobyrsa rhododendri*, Horv., which has previously been recorded in America under the name *L. explanata*, Heid. This insect has a wide distribution from Massachusetts to Florida and westwards to Ohio and has been introduced into Europe on imported nursery stock. It occurs on *Rhododendron maximum*, *Kalmia latifolia*, and azaleas, feeding on the under-surface of the leaves.

EWING (H. E.). **Parthenogenesis in the Pear-slug Saw-fly.**—*Ann. Entom Soc. America, Columbus. Ohio*, x, no. 4, December 1917, pp. 330-336.

Eriocampoides limacina (*Caliroa cerasi*) (common pear-slug or cherry-slug) is a sawfly in which the males are so rare as to be practically non-existent, and in which, therefore, parthenogenesis has long been suspected to occur, though in *Profenusa collaris*, MacG. (cherry and hawthorn sawfly leaf-miner) the proportion of males and the life-history appear to be normal.

The earliest experiments with *E. limacina* showed that virgin females deposit eggs that hatch, but that the larvae never survived more than a few days. The author's recent investigation has, however, established the fact that the eggs deposited by spring-brood virgin females hatch and produce normal vigorous larvae, which feed normally, pupate, and finally produce adults, which are females only. Parthenogenesis, when continued in the offspring of this second or summer brood of adults, gave larvae of which a great number failed to pupate, the remainder pupating and either failing to transform into the adult stage, or failing to emerge from the enclosing earthen cells.

An orchard heavily infested with spring-brood females sustained such injury that several cherry trees were killed outright, owing to the enormous number of second-brood females and their second-brood larvae parthenogenetically produced. The following spring, however, saw the emergence of only a very few adults, probably owing to a lack of vigour due to the absence of fertilisation, though possibly due also to unknown causes.

LICHTENSTEIN (J. L.). **Observations sur les Coccinellides mycophages (Col.).** [Notes on Mycophagous Coccinellids.]—*Bull. Soc. Entom. France, Paris*, no. 17, 14th November 1917, pp. 298–299.

Many authors have recorded the fact that many Aphid-destroying species of Coccinellids may become phytophagous even to the extent of being injurious to vegetation. Examination of the intestinal contents has shown that various species of these insects feed indifferently on Arthropods, pollen grains and spores of fungi. It has more recently been found that *Halyzia (Thea) vigintiduopunctata*, L., and *H. (Vibidia) duodecimguttata*, Pod., have similar habits, which the author has also shown to be the case with *H. sexdecimguttata*, L.. At Montpellier, these three species feed on *Phyllactinia suffulta*, a widely distributed fungus that attacks the lower surface of the leaves of hazel, ash, and *Cornus sanguinea*.

VILLENEUVE (J.). **Descriptions de deux Muscides nouveaux (Dipt.)** [Descriptions of two new Muscids.]—*Bull. Soc. Entom. France, Paris*, no. 17, 14th November 1917, pp. 306–309.

The Muscids described in this paper are *Hyperecteina polyphyllae*, sp. n., found feeding in the larval state on the dead bodies of the Lamellicorn beetle, *Polyphylla fullo*, L., in Russia, and *Scatophaga rufiventris*, sp. n., parasitising the same beetle by laying its eggs on the abdomen of the living insect.

BIELOUSSOV (V.). **Соболиная Тайга Р. Кизира.** [The Sable Forests on the River Kizir.]—**« Лѣсной Журналъ.»** [*Forestry Journal*], *Petrograd*, xlvii, no. 7-8, 1917, pp. 418–450. [Received 16th January 1918.]

This article dealing with the fauna of the forests in Siberia contains a list of Scolytids occurring in them, which has already been given in a previous paper [see this *Review*, Ser. A, v, p. 514].

The following CERAMBYCIDAE were also observed:—*Monochamus sutor*, L., *M. mulsanti* var. *rosenmuelleri*, Cederhj., which prefers

freshly cut firs to all other trees, *Leptura quadrifasciata*, L., *L. sequensi*, Reitt., *L. nigripes*, DeG., *L. melanura*, L., *Acmeops pratensis*, Laich., and *Lamia textor*, L., as well as a Clerid, *Trichodes ircutensis*, Laxm.

BELIAIEV (K. A.). **Гессенская муха въ Ставропольской губерніи, ея естественные враги и мѣры борьбы съ нею.** [*Cecidomyia destructor*, Say, in the Govt. of Stavropol, its natural Enemies and Remedies for it.]—Published by the Entomological Bureau of the Zemstvo. *Stavropol.*

Mayetiola (*Cecidomyia*) *destructor* (Hessian fly) has three generations in the Government of Stavropol. The first is on the wing in May and oviposits both on winter and summer-sown crops; the larvae of this generation pupate in the first half of July, the second generation of adults appearing in August. These oviposit exclusively on plants from self-sown seed. The third generation appears in the second half of October and oviposits on young shoots of winter-sown crops, the larvae pupating in November and hibernating in the pupal stage. Thus the casual plants from self-sown seed are the only means by which the second and consequently the third generation survive, and their destruction is therefore one of the chief control measures.

Amongst the natural enemies of the Hessian fly the most important are a Hymenopteron parasitic on the larva and a yellow centipede which feeds on the larvae and pupae.

NIKOLAIEV (P.). **Озимая совка (озимый червь). Образъ жизни ея, вредъ, наносимый ею полямъ, и мѣры борьбы съ нею.** [The Caterpillars of *Euxoa segetum*, their Life-History, the Damage caused by them to Fields, and the Remedies for them.]— **« Южное Хозяйство.»** [*Southern Husbandry*], *Ekaterinoslav*, 1917, pp. 304–310, 6 figs. [Received 16th January 1918.]

A short account of *Euxoa segetum* with figures of its various stages is given, followed by a popular account of its life-history, damage and control. It is stated as an historical fact that in 1839 this pest appeared in vast numbers practically all over agricultural Russia, and the damage done was so great that the resulting shortage of food led to riots in many parts of the country.

NOEL (P.). **Une Invasion d'Insectes americains à Rouen.** [An Invasion of American Insects at Rouen.]—*Bull. Lab. Rég. Entom. Agric., Rouen*, 1st quarter 1918, January-March, p. 14.

The houses of a certain district in Rouen recently became infested with vast numbers of minute insects that covered the inner and outer walls from roof to cellar, as well as furniture, clothing and everything in them in such numbers as to appear like a fine grey dust. The insects concerned consisted of *Tyroglyphus farinae*, thrips, many Podurids, and a few corn and rice weevils. It was evident that these insects came from some granary, and a large shed was discovered in the midst of the infested houses that had been used to store corn and barley siftings from America bought two years previously, and in this the insects, mostly new to the French fauna, had been multiplying enormously. The removal and destruction of the infested grain refuse

was effected, and the shed was then fumigated with sulphur and washed down with a solution of bichloride of mercury in order to destroy any unhatched eggs and to disinfect the building. This treatment has apparently been quite efficacious.

PATTERSON (W. H.). **Report of the Entomologist.**—*Gold Coast Agric. Dept. Rept. for 1916*; *Accra*, 1917, pp. 19–20. [Received 22nd January 1918.]

Cacao has been attacked by *Sahlbergella singularis*, Hag., *S. theobroma*, Dist., and *Helopeltis bergrothi*, Reut. (cacao mosquito), the great increase of the *Diplodia* fungus being due to the destruction of tissue caused by the poisonous injections of these bugs.

Coconuts have been badly infested with *Archon centaurus*, Burm. (rhinoceros beetle), 8,165 adults having been captured as against 4,033 for the preceding year. This is unfortunate in view of the fact that efforts are being made to introduce coconut cultivation in districts unsuited to cacao. The beetle breeds in accumulations of organic matter in and on the ground and has been found in the masses of decaying debris collected at the base of the leaves of the oil palm. Some 1,300 adults were caught on a small group of *Pandanus* at Aburi, in which district there are numerous breeding sites.

The heavy fall of citrus fruits has been proved to be due to the attacks of the orange-piercing moths, *Ophideres* (*Othreis*) *fullonica* and *Achaea obvia*, which visit the trees at night and puncture the fruits before they are quite ripe. These pests are very widespread and do a great deal of damage to the main-season crop of fruits; it is estimated that three-fourths of the orange and grape-fruit crops at Aburi and the whole crop of tangerines at Assuantsi were destroyed by them. *Ceratitis* however was not found in any citrus fruits nor in sufficient numbers in other fruits to be of any economic importance. The control of these moths is difficult, since the netting of the trees is too costly, as is also the supervision necessary for maintaining smother fires at night. The use of poison-baits is of doubtful value owing to the vast numbers in which the pest appears, and the provision of early, or artificially ripened fruits as bait is not a safeguard, as the moths utilise as food fruit that is far from mature. The breeding habits of these insects is unknown, though the larval stage is probably passed upon wild food-plants.

Homoeocerus sp., the "big bug" of cacao fruits, has been found feeding and breeding to a small extent on the young shoots of Para rubber (*Hevea brasiliensis*).

GUNTHER (R. T.). **Report on Agricultural Damage by Vermin and Birds in the Counties of Norfolk and Oxfordshire in 1916.**—*Oxford Univ. Press*, 1917, 92 pp. [Received 29th January 1918.]

In the course of this investigation into the agricultural damage by vermin and birds the author found that starlings are beneficial during the earlier half of the year, their diet then consisting chiefly of beetle larvae, Carabid beetles, millipedes, crane-fly larvae, Lepidopterous

larvae, wireworms, click beetles and weevils, but that the preservation of this bird in great numbers would ensure the local extinction of many more useful migrant insectivorous birds.

Similarly pheasants, when in abnormal numbers, may be a potential source of harm to the farmer, but ordinarily are beneficial, as their food consists largely of the seeds of weeds, *Bibio* larvae, wireworms, click beetles, plant lice, garden chafers, ants, and crane-flies. There are excellent grounds for the belief that pheasants are a valuable remedial measure on land infested with wireworms, estates on which they are preserved being practically free from this pest, owing to the fact that the young birds are entirely insectivorous.

Sanderson (E. D.) & Peairs (L. M.). **School Entomology: An Elementary Textbook of Entomology.**—*New York*, John Wiley & Sons, Inc. *London*, Chapman & Hall, Ltd., 356 pp., 233 figs. Price 7*s*. net.

This textbook presents the subject of entomology in a simple manner and is suitable for use in secondary schools or agricultural short courses. The first part deals with general entomology, a chapter being allotted to each of the principal natural orders. The second part comprising six chapters on economic entomology and insect control are planned with the object of giving in a limited space as concise an idea as possible of the commoner injurious forms in America, and the composition of the more usual insecticides employed against them. The text is profusely illustrated and the appendices contain useful lists of publications on injurious insects, while a general index to the volume is included.

The value and importance of textbooks such as this must be generally admitted, when it is realised—to quote from the preface—that the total annual loss due to insect injuries in the United States is estimated "at not far from the stupendous sum of one billion dollars," grain and forage crops bearing about one-third of this total.

Guénaux (G.). **Entomologie et Parasitologie Agricoles.**—*Encyclopédie Agricole, Paris*, J. B. Baillière & Fils, 1917, 592 pp., 427 figs. 3rd Edition, revised and enlarged. Price: paper, 5 francs; cloth, 6 francs.

This new edition is one of two volumes on agricultural zoology, and deals exclusively with Invertebrates injurious to agriculture. The bulk of the volume is given to the insects, and this section begins with a general description of the structure and classification of insects with the essential characteristics and principal subdivisions of the various families. Following this is a review of the insects noxious to cultivation, classified under the various crops which they damage. Finally, the insects attacking domestic animals and man, houses, timber, clothing and food are dealt with, as well as those beneficial to crops.

The book is designed primarily for the growers of plant crops, who only too frequently have no means of recognising or dealing with the

various species that they encounter, nor of distinguishing beneficial from noxious species. This information is given in a simple and concise form and the author has produced an essentially practical handbook, illustrated with numerous figures. It is hoped that the present volume, which forms one of a series on these lines, will refute the frequently expressed opinion that scientific agronomic knowledge has no place in the domain of practical experience.

The volume is supplied with adequate indices, both general and classified, as well as a plant index.

SCHOEVERS (T. A. C.). **Het Stengelaaltje als Tabaksvijand.** [The Eelworm as a Pest of Tobacco.]—*Tijdschr. over Plantenziekten, Wageningen*, xxiii, no. 5, November 1917, pp. 167–180, 2 plates.

In 1916 tobacco at Deest was injured by *Tylenchus devastatrix*, Kühn, and the attack was repeated in 1917. The bast of the affected plants rotted away completely, just above the ground, while higher up it was dark brown in colour and in a decaying condition. Above this the stem was green and vigorous, but covered with excrescences. The shoots in infested plants were much hypertrophied and deformed, and most of their leaves were small, while even those of normal size were marked with yellow-green spots. The atrophy of the valuable shoots, the breaking of the stem near the ground and the reduced value of the spotted foliage constitute the damage done to tobacco by *T. devastatrix*.

At Deest the cultivation of tobacco has been given up in consequence in many plots, though adjacent ones have been unaffected. Crop rotation provides the best remedy, but it is one that tobacco growers are naturally reluctant to adopt. At present no measures have been found that will check the pest without interfering with the tobacco. After harvesting the stems are usually left in the fields until the spring, thus permitting the Nematodes to migrate to the ground. The stems must be stored under conditions that render them harmless or burnt without delay. Infested leaves and shoots must be immediately burnt. If the conditions permit, the upper layer of soil may be buried at a depth where the presence of sufficient moisture will cause the eelworms to starve by preventing them from passing into a latent condition. The application of large quantities of potash as a manure also appears to be useful. Earthing up the infested plants may enable them to put forth roots above the diseased point and thus obtain the sap necessary for development of the shoots.

VAN POETEREN (N.). **Bestrijding van Dopluis op Perzik en Druif.** [The Control of Scale-Insects on Peach and Vine.]—*Tijdschr. over Plantenziekten, Wageningen*, xxiii, no. 6, December 1917, pp. 195–203, 1 plate.

This paper strongly recommends water-soluble carbolineum against *Eulecanium corni* and *Pulvinaria betulae* infesting peaches and vines grown under glass. The solutions must be of 2–5½ per cent. strength for the peach and 4–8 per cent. for the vine.

SCHENK (P. J.). **Vijanden van Bladluizen.** [Enemies of Aphids.]—*Tijdschr. over Plantenziekten, Wageningen,* xxiii, no. 6, December 1917, Bijblad pp. 37–45.

This paper briefly reviews the various insect enemies of Aphids found in Holland, which require to be protected instead of destroyed, as often happens at the present time. They include Coccinellids, of which *Coccinella septempunctata* is the most important; *Telephorus fuscus* and allied beetles; Hemerobiids; Chrysopids, including *Chrysopa perla*; Syrphids, including *Syrphus nitidicollis* and *Lasiophthicus* (*S.*) *pyrastri*; Ichneumonids; and fossorial wasps, such as *Psen pallipes*, Pz. (*atratus*, F.), *Mimesa* sp., *Pemphredon* sp., and *Diodontus* sp.

LEGISLATION.

Phylloxera in Italy.—*Jl. Bd. Agric., London,* xxiv, no. 10, January 1918, p. 1159.

The importation into Italy of all plants and parts of living plants and of vegetable or mixed manure, except in certain specified cases within tbe control of the Minister of Agriculture, has been prohibited by a decree dated 2nd September 1917, witb a view to controlling the spread of *Phylloxera.* Prohibited plants may be imported, however, by special permit for the use of public botanical institutions, provided that they come direct from places in whicb vines are not cultivated at all.

The decree also defines the powers of the Consulting Commission for Defence against Diseases of Plants in regard to *Phylloxera,* provides for the notification and inspection of infected areas and the formation of anti-phylloxera associations, and lays down penalties for any contravention of these provisions.

Amendment to the General Regulations under the Destructive Insect and Pest Act.—Order in Council no. 340, *Ottawa,* 11th February 1918.

The Governor-General of Canada, on the recommendation of the Minister of Agriculture, has ordered an amendment to the general regulations under the Destructive Insect and Pest Act of 1917 [see this *Review,* Ser. A, v, p. 479]. This amendment alters the regulation concerning non-canned fruits, plants or portions of plants or vegetable matter from the Hawaiian Islands, in order to except pineapples (*Ananassa sativa*) and bananas (*Musa* spp.), which may be imported provided they have been inspected by the United States Department of Agriculture, certified free from infestation by the Mediterranean fruit-fly [*Ceratitis capitata*], and that the boxes, crates, bales or other containers shall be marked with the name and address of the consignor and of the consignee and bear the original or a duplicate copy of the certificate of inspection.

Maskew (F.). **Quarantine Division. Report for the Month of May 1917.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, vi, no. 8, August 1917, pp. 347–348. [Received 24th January 1918.]

The following pests were intercepted:—From Australia: *Venturia pyrina* on pears; *Rhizoctonia* and *Phthorimaea operculella* on potatoes. From China: *Calandra oryzae* in rice; Lepidopterous larvae in dry herbs; Coccids on plants; *Hemichionaspis* sp. on lichi trees. From Hawaii: *Diaspis bromeliae* and *Pseudococcus bromeliae* on pineapples; *Chrysomphalus* sp., *Parlatoria* sp., *Pseudococcus* sp. and cicada eggs on palm; larvae of *Dacus cucurbitae* in cucumbers. From Japan: Mites in bulbs, weevil larvae in chestnuts and sweet potatoes; *Pulvinaria* sp., *Hemichionaspis aspidistrae* and *Lepidosaphes* sp. on citrus cuttings; *Poliaspis pini* on a pine tree. From Mexico: *Calandra* sp. in seeds; Lepidopterous larvae in seeds; *Lepidosaphes beckii* on limes; *Heliothis* (*Chloridea*) *obsoleta* in tomatoes; weevils in tamarinds. From New Jersey: *Diaspis boisduvali* and *Isosoma cattleyae* on orchids. From Panama: Lepidopterous pupae on orchids. From Papeete: *Morganella maskelli* and *Lepidosaphes beckii* on oranges. From Pennsylvania: *Dialeurodes citri* and *Coccus hesperidum* on citrus trees; *Saissetia hemisphaerica* on gardenias. From Illinois: *Aspidiotus lataniae* and *Saissetia oleae* on ornamental plants. From New York: A borer (? *Lixus concavus*) in rhubarb roots. From Ohio: *Pseudococcus* sp. and *Orthezia* sp. on ornamental plants.

Collins (G. N.). **Breeding Sweet Corn Resistant to the Corn Earworm.**—*Jl. Agric. Research, Washington, D.C.*, xi, no. 11, 10th December 1917, pp. 549–572.

Sweet maize is grown very little in the southern United States or in the tropics generally, the chief reason probably being the ravages of the corn earworm, *Heliothis* (*Chloridea*) *obsoleta*, F., which generally destroys almost the entire crop, whilst the native field varieties suffer but little injury and are consequently largely used as a substitute. The most obvious difference between the sweet and field varieties that might be expected to affect the activities of this caterpillar is the extent to which the ears are protected by husks. The husks in sweet varieties are generally poorly developed, perhaps because in the maize-growing belt one of the most desired characteristics is an early season, and early varieties generally produce few leaves and few husks. Crosses were therefore made between commercial varieties of sweet maize and southern field varieties in order to combine the well-protected ears of southern varieties with the eating qualities of sweet varieties, hoping to raise a strain of sweet maize with some degree of immunity. These hybrids were found to possess distinctly greater immunity than the commercial sweet varieties, while the constitution of the plant was also found to be an important factor in immunity. A small percentage of damage was found to be correlated with a number of morphological characters, of which prolongation, or the extent to which the husks exceed the ear, was apparently the most important. The thickness of the covering provided to the ear by the husks was also found to be associated with low damage, but since only 5 per cent. of the larvae that reach the ear

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do so by penetrating the husks the relation can hardly be a direct one of cause and effect. The presence of husk leaves is also shown to be undesirable. By recording the number of larvae in each ear it is possible to resolve the total damage into the number of larvae and the average amount of injury done by each. In the more immune varieties both the number of larvae and the damage per larva were low. Since the number of larvae must be determined largely by the choice exercised by the moth in depositing eggs, it follows that the plants avoided by the moths are also those that the larvae find most distasteful. This identity of instincts in adult and larva is difficult to explain as the result of morphological characters of the plant and seems to indicate that at least a part of the immunity is the result of chemical differences, perhaps the presence of some volatile substance distasteful alike to both stages. Both in California and Maryland the injury from *H. obsoleta* decreased slightly as the season advanced.

These experiments indicate that by increasing the length and thickness of the husk-covering and reducing the husk-leaves, varieties of sweet maize can be produced in which damage from *H. obsoleta* is materially lessened. No difficulty was experienced in securing by hybridisation and selection the desired plant characters in combination with the seed characters of sweet maize.

ILLINGWORTH (J. F.). **The Sugar-Cane Grub Pest.**—*Queensland Agric. Jl., Brisbane*, viii, no. 3, September 1917, pp. 173–175. [Received 24th January 1918.]

In these notes the author lays particular emphasis upon the benefit to be derived from cultural operations in sugar-cane growing. The problem of the control of sugar-cane grubs is not an easy one. The introduction of parasites into Queensland would probably be of little avail, since the cane grubs are native insects, and introduced parasites have only been successfully used against introduced pests. There are already a number of parasitic and predaceous insects attacking the grubs, but these are themselves largely attacked by other parasites. About one-third of the grubs appear to succumb to the attacks of bacteria and parasitic fungi, and these undoubtedly lend themselves to artificial propagation and transplanting. The soils of badly-infested fields were all found to be very poor in humus and usually contained no lime and these two factors appear to be of vital importance to the growth of sugar-cane in a grub-infested district. The chief food of the grubs is decomposing organic matter in the soil and, if this is lacking, they are forced to feed upon the living roots of plants. Lime improves the character of the soil by hastening the humification of plant tissues and its action is also favourable to the development of fungous parasites.

The general custom in all grub-infested districts has apparently been to destroy the principal humus-forming elements by burning all the rubbish and failing to grow sugar-cane in rotation with a green crop. The conservation of soil moisture is an important factor in the growth of cane, making it more resistant to the attacks of grubs, and also materially assisting the development of fungous organisms destructive to the grubs. These cannot thrive in dry soil; hence the well-known fact that grubs are more destructive in a dry season or upon dry soil.

The action of nitrate of soda or sulphate of ammonia is a great stimulus to plant growth and root development, making the cane more resistant to the attacks of grubs.

The use of arsenious poisons recently suggested for the destruction of the grubs is very promising. As it is already known that they feed largely upon humus and decomposing soil substances, it would seem to be a simple matter to apply poisoned organic bodies to the soil preparatory to cane-planting. Humus has a marked affinity for arsenic, which has a deflocculating action upon soil, making it more retentive of moisture. Chemical tests of certain soils of Hawaii, which have been treated with arsenic for the destruction of weeds for the past five years, show that all the poison has remained in the top four inches of soil without injuring in any way the roots of the growing crop. If arsenic proves useful at the same time as a weed-killer and a poison for grubs, it will undoubtedly be a profitable procedure. Experiments are now in course of progress to test the various suggestions outlined. Meanwhile, advice for cane-growers may be summarised into the general recommendation to conserve the humus and apply lime; later it is hoped to publish the best method of poisoning the grubs.

JARVIS (E.). **Sugar-Cane Pests.**—*Queensland Agric. Jl., Brisbane,* viii, no. 3, September 1917, p. 175. [Received 24th January 1918.]

Attention has been principally devoted to the study of the external anatomy and metamorphosis of certain of the more injurious cane beetles. A treatise dealing with the life-history and habits of *Lepidiota frenchi,* Black., has been prepared. The occurrence is recorded at Gordonvale in May 1917 of a new Lepidopterous pest of sugar-cane of minor importance, viz.:—the Hesperid, *Padraona hypometoma,* Lower, which was observed eating the leaves of young cane plants growing in pots. Three other species of Hesperids have previously been recorded attacking sugar-cane in this district [see this *Review,* Ser. A, iv, p. 345]. The butterfly, *Melanitis leda,* L., and the moth, *Mocis frugalis,* F., have also been recently recorded as destroying the foliage of sugar-cane.

FREEMAN (G. F.). **Alfalfa in the Southwest.**—*Univ. Arizona Agric. Expt. Sta., Tucson,* Bull. no. 73, 1st June 1914, pp. 233–320, 2 plates, 19 figs. [Received 25th January 1918.]

The lucerne seed crop is attacked by several insects, of which the most important is the Chalcid, *Bruchophagus funebris,* which oviposits in the ovules soon after the flower has bloomed, or in the young seeds in pod. By the time the seed is mature the larvae are full grown, having devoured all the interior of the seed, the winter being passed by them in seeds fallen from the previous crop or from casual roadside plants. Adults appear early in June and continue to emerge throughout July and August, and since the time of incubation may vary from a little less than six weeks to nearly a year, there is no discernible interval between the appearance of the first and second and succeeding broods. The amount of damage varies with the season, and increases as the season advances, becoming so severe in October that seed maturing at that time is not worth harvesting.

The best means of control is the destruction of over-wintering larvae by ploughing in fallen seeds and cutting and burning roadside plants, while the ravages of the insect can be avoided by producing the seed-crop in early spring before it becomes numerous enough to do damage.

The midge, *Asphondylia miki*, over limited areas may sometimes destroy 25–30 per cent. of the pods, which have been found to contain its small reddish orange larvae, but injury on a large scale has not hitherto been observed. Thrips may attack the crop in such numbers that the flowers fail to set seed, though their damage usually consists in discolouring the flowers.

The alfalfa caterpillar, *Colias* (*Eurymus*) *eurytheme*, Boisd., is the most serious pest affecting the lucerne hay crop [see this *Review*, Ser. A, iii, p. 153]. *Stictocephala festina*, Say (green alfalfa-hopper), causes some damage, too slight however to require special methods of control. Grasshoppers, *Melanoplus* spp., occasionally do considerable damage, and are best controlled in the egg-stage by winter disking and by the keeping of turkeys. The harvester ant, *Pogonomyrmex* sp., is a most destructive pest, clearing away all the vegetation from a space surrounding the nest, 3 to 20 ft. in diameter. The ants are best destroyed by pouring in and around the opening of each large nest a solution of potassium cyanide (1 oz. dry cyanide to 1 U.S. gal. water). This treatment must be repeated at intervals of 8 to 10 days, as the eggs are not destroyed and continue to hatch out. *Lycophotia* (*Peridroma*) *margaritosa* (variegated cutworm), a severe outbreak of which occurred in 1911, was found to be so heavily parasitised that no subsequent injury has been caused by it. *Hypera* (*Phytonomus*) *murina*, F. (alfalfa weevil), at present unknown in Arizona, occurs in an adjoining State, and quarantine measures have been taken against the importation of household goods, live-stock and hay from infested districts.

Antoniadis (P.). **Recherches sur la Pyrale.** [Researches on *Sparganothis pilleriana*.]—*Progrès Agric. Vitic.*, *Montpellier*, lxix, no. 1, 6th January 1918, pp. 9–12, 1 fig.

Sparganothis pilleriana, which hibernates in the larval form in the fissures in the bark of the vine, does not affect any part of the stem indiscriminately, but is characterised by a definite distribution. Thus the larvae decrease in number from the tip to the base of a branch, and are absent from the trunk of the main stem. Consequently the hiding places of the pest are known with certainty, rendering the application of control measures simple and more efficacious. Painting or spraying the vine with insecticides will be useless unless the ends of the branches are treated; but if this be done, the insecticide, aided by the action of rain, will readily reach the lower parts.

Dopluis op Perzik en Druif. [Scale-Insects on Peach and Vine.]—*Meded. Phytopath. Dienst, Wageningen*, no. 5, November 1917, 16 pp., 2 plates.

This bulletin briefly describes the habits of *Eulecanium* (*Lecanium*) *corni*, Bch., and *Pulvinaria betulae*, L. The former infests peach, plum, *Acacia*, currant, gooseberry, raspberry, ornamental shrubs, *Thuja* and

other conifers, as well as the vine. *P. betulae* however is the species chiefly found on the last-named plant. *E. corni* occurs throughout Holland wherever the peach is cultivated, as is especially the case in Westland; it is spread by means of infested plants. *P. betulae* is not so common, and a large proportion of the vines in Westland are free from infestation.

The mechanical removal of the scales in winter is a useful remedial measure, but it must be repeated annually and is expensive on account of the time required, especially in the case of the peach. Spraying with lime, sulphur or both combined, is also useful, but not completely effective. Petroleum has been employed with good results against *E. corni*, but with the advent of sprayers yielding a very fine, powerful spray and of water-soluble carbolineum the latter substance has been used exclusively. By spraying the immature scales the loss of sap is prevented, and numerous trials have proved that this treatment is harmless both to peach and vine. It is important to choose a brand which yields a milk-white emulsion when diluted with water. For the peach the correct strength is 1 part carbolineum to 20 parts water, and for the vine, 1 part in 14–16. The solution must be sprayed, not applied as a wash, and the work must be done while the trees are quite dormant, *i.e.*, not later than December or January. This treatment will also serve against the spinning mite [*Tetranychus*] and *Pseudococcus* sp. on the vine and against the spinning mite, *Phenacoccus aceris*, and other scales on the peach.

D'Emmerez de Charmoy (D.). **Report of the Work of the Division of Entomology.**—*Ann. Rept. Dept. Agric. for 1916, Mauritius,* 1917, pp. 9–10. [Received 30th January 1918.]

Mango trees are reported to have suffered much from the scale, *Coccus* (*Lecanium*) *mangiferae*, and from the attacks of a Cecidomyid fly, which oviposits in the tissue of the young leaves and stems, forming galls which seriously interfere with the normal growth of the plant. Sugar-cane has been severely attacked by *Oryctes tarandus*, the destruction of this beetle on one estate costing nearly £1,800. Another sugar-cane pest, a species of *Lachnosterna*, has been held in check by its natural enemy, the Scoliid wasp, *Elis rufa*, as well as by trapping the adult beetles at night, and thoroughly digging out the larvae. *Elis rufa* has been distributed in large numbers on sugar estates. Work has continued against *Phytalus smithi*, resulting in the destruction of 2½ million larvae and 66 million beetles in 1916. *Tiphia parallela* imported from Barbados has become firmly established, being found in great numbers on its food-plant, *Cordia interrupta*.

Froggatt (W. W.). **A Lead-boring Beetle** (*Xylothrips gibbicollis*).—*Agric. Gaz. N. S. W., Sydney,* xxviii, no. 11, 2nd November 1917, p. 814, 1 fig.

The Bostrychid beetle, *Xylopsocus* (*Xylothrips*) *gibbicollis*, described originally from Southern Queensland, but now known to have a wide range over Australia, under ordinary conditions bores into dead and dying trees, ovipositing in the timber, upon which both larvae and adults live. Of recent years it has been found boring minute holes in

the lead sheathing protecting overhead telephone wires, allowing moisture to enter the cable, and disorganising communication by destroying the insulation. At present, no suitable means of preventing this damage is known, as the cost of painting the cables with a repellent mixture would be too great.

HITIER (H.). **La Piéride du Chou.** [*Pieris brassicae.*]—*Jl. d'Agric. Pratique, Paris,* xxxi, no. 2, 24th January 1918, p. 37.

In 1917 an outbreak of *Pieris brassicae* occurred in Brittany of such severity that whole fields of forage and kitchen-garden cabbages were destroyed, nothing remaining of the plants but the stems and midribs of the larger leaves. Fortunately the larvae were so heavily parasitised by a Braconid, *Microgaster* sp., that the pest was held in check, though the numbers of the second generation showed that it is unwise to trust solely to this natural control.

TRABUT (Dr.). **Les Abris à Altises.** [Shelter-plants for *Haltica.*]—*Bull. Agric. Algér. Tun. Maroc, Algiers,* xxiv, no. 1, January 1918, pp. 9–10.

The depredations of *Haltica ampelophaga* in Algeria, which have been in abeyance for some years, have recently taken place again to an extent necessitating special methods of control on the part of vine-growers. The simplest and cheapest seems to be that of providing winter-shelters near the vines in the form of hardy perennial plants in which the pest hides and in which it can be easily destroyed before its emergence in the spring. Plants suited to this purpose include: *Pennisetum villosum* and *P. ruppelianum, Chloris gayana, Mischantus sinensis, Andropogon muricatus, Oryzopis miliacea, Festuca arundinacea* and *Antholyssa aethiopica.*

When sheltering in this low herbage, the beetle is in a position that lends itself to attack by the fungus *Sporotrichum,* which can be easily disseminated, by placing infected individuals in situations as yet free from the fungus. New cultures may be obtained from the Pasteur Institute. The torpid hibernating insects can also be destroyed by fire or with insecticides.

GIROLA (C. D.). **Instrucciones populares sobre el Cultivo del Trigo en Argentina.** [Popular Instructions for the Cultivation of Wheat in the Argentine.]—*Anales Soc. Rural Argentina, Buenos Aires,* li, no. 2, March-April 1917, pp. 185–212. [Received 31st January 1918.]

In the course of these notes on wheat-growing a section is devoted to insect pests and diseases liable to attack growing wheat. Ants should be kept from the young wheat-plants by destruction of the ant-hills whenever possible with carbon bisulphide, cyanide of potassium or ant-exterminating machines. The nests should, if possible, be plastered over. Winged locusts should be frightened away by noise, smoke, or similar methods, while the hoppers should be kept from the wheat by trenches and ditches, or destroyed by naphtha or any of the well-known insecticides. Various pests attack wheat both in the green

state and after the ear has formed; these include *Cirphis* (*Leucania*) *unipuncta*, Haw., which can be controlled by trenches dug round the plots or by the application of insecticides such as Paris green. The larva of a beetle, *Diloboderus abderus*, Burm., feeds on the roots of wheat and other plants and should be destroyed by deep cultivation of the fields, while sowing should be done at the most favourable time to allow the plants every opportunity for vigorous growth.

The stored grain is attacked by the moth, *Sitotroga cerealella*, Ol., the weevil, *Calandra granaria*, L., and the beetle, *Tenebroides* (*Trogosita*) *mauritanicus*, L., as well as other insects.

Osservatorio Autonomo di Fitopathologia, Turin, Mthly. Leaflets, nos. 1–12, January-December 1917, 48 pp.

These leaflets for 1917 are similar to those for the preceding year [see this *Review*, Ser. A, v, p. 180].

Among the injurious insects recorded are the following:—

Lepidoptera: *Argyroploce* (*Grapholitha*) *variegana* on cherry; *Aegeria* (*Sesia*) *apiformis* and *A.* (*S.*) *asiliformis* on poplar; *Cydia* (*Carpocapsa*) *pomonella* on apple and pear; *Cydia* (*Grapholitha*) *funebrana* on prune and plum; *Cossus cossus*, L., on poplar and apple; *Clysia* (*Conchylis*) *ambiguella* on vine; *Cydia* (*Carpocapsa*) *splendana* on walnut; *Cnethocampa pityocampa*, Schiff., on pine; *Hyponomeuta malinellus* on apple; *Barathra* (*Mamestra*) *brassicae* on cabbage; *Nygmia phocorrhoea* (*Euproctis chrysorrhoea*) on chestnut, pear and peach; *Polychrosis botrana* on vine; *Pieris brassicae* on cabbage; and *Zeuzera pyrina* (*aesculi*) on apple.

Coleoptera: *Agriotes lineatus* on lettuce; *Anthonomus pomorum* on pear; *Ceuthorrhynchus sulcicollis*, Payk., on cabbage; *Crioceris asparagi* on asparagus; *Hylesinus fraxini* in cherry; *Hylobius abietis* in pine; *Haltica oleracea* on cabbage; *Galeruca luteola* (*xanthomelaena*) on elm; *Phloeosinus thujae* in thuja; *Byctiscus betulae* (*Rhynchites betuleti*) on vine; *Tychea setariae* on endive; and *Xyleborus dispar* in apple.

Hymenoptera: *Eriocampoides* (*Caliroa*) *limacina* and *Hoplocampa brevis*, Klug, on pear.

Rhynchota: *Aleurochiton aceris*, Geof., on plane; *Stephanitis* (*Tingis*) *pyri* on pear and Japanese medlar. COCCIDAE: *Aulacaspis rosae* on rose; *Aonidia lauri* on laurel; *Aulacaspis pentagona* on jasmine, lilac, mulberry, mimosa, peach, geranium, pelargonium, *Kentia*, oleander, hazel and catalpa; *Aspidiotus hederae* (*nerii*) on oleander, *Aucuba japonica* and palm; *Ceroplastes rusci* on fig; *C. sinensis* on orange; *Chrysomphalus dictyospermi* var. *pinnulifera* on camellia; *Coccus hesperidum* on lemon; *Coccus* (*Lecanium*) *elongatus* on laurel; *Epidiaspis piricola* on pear; *Eulecanium* (*Lecanium*) *persicae* on lemon; *Lepidosaphes ulmi* (*Mytilaspis pomorum*) on pear and hawthorn; *Pulvinaria vitis* on vine; *Pulvinaria camelicola* on camellia; and *Saissetia oleae* on olive. APHIDAE: *Aphis persicae* on peach; *A. ribis* on currant; *A. rosae* on rose; *A. brassicae* on cabbage; *A. piraria* on pear; *A. fabae* on beans; *Chermes strobi* on *Pinus strobus*; *Hyalopterus arundinis* (*pruni*) on prune; *Eriosoma* (*Schizoneura*) *lanigerum* on apple and elm; and *Toxoptera aurantii* on camellia.

Diptera: *Acidia heraclei* on celery; *Contarinia pyrivora* on pear; *Oscinella* (*Oscinis*) *frit* on corn; *Platyparea poeciloptera* on asparagus;

Rhabdophaga (*Cecidomyia*) *saliciperda* on willow; and *Perrisia crataegi* on hawthorn.

Mites: *Eriophyes salicis* on willow; *E. pyri* on pear; *E. tiliae* on lime; *E. vitis* on vine; *E.* (*Phytoptus*) *coryli* on hazel; and *Tetranychus telarius* on vine and *Acacia*.

LEONARDI (G.). **La Processionaria del Pino in Liguria.** [The Pine Processionary Caterpillar in Liguria.]—*Minerva Agraria, Milan*, ix, no. 19–20, 15th–31st October 1917, pp. 227–228. [Abstract from *Boll. Assoc. Orticola Professionale Italiana*, no. 1, January 1917.]

An outbreak of *Cnethocampa* (*Thaumetopoea*) *pityocampa* in Liguria in both gardens and pine woods in the hilly districts is described. Unless remedial measures are applied without delay great loss will result. The adult moths usually appear in the second half of July. They fly at twilight, remaining inactive in sheltered situations on their host-plant by day. The females lay from 100 to 200 eggs in small batches placed on the pine needles. The caterpillars hatch towards the end of August; they first feed on the tender needles and then attack the older ones. They are gregarious and leave their nest only at night in order to seek food. After the first moult in September they enlarge and strengthen their nest and withdraw to it on the approach of the cold weather, not reappearing until the following spring when the temperature is at least 42°–43° F. The second and third moults then take place. When mature the caterpillars spin a cocoon about 4 inches beneath the surface of the ground, and the adults emerge after a pupal period lasting 6 weeks. When infestation is severe, a tree may be entirely defoliated and its vertical growth arrested if a nest occurs on the leading shoot. Plants weakened by infestation become an easy prey for Scolytid beetles and other insects.

The destruction of the nests in autumn and winter is the cheapest and most effective means of dealing with *C. pityocampa*. The nests may either be removed and burnt or burnt *in situ* by means of suitable torches. If the leading shoot is infested it is best to drench that portion of the tree with a 1 per cent. solution of lead arsenate. As a protection against the stinging hairs of the caterpillars, workers should wear motor goggles and should oil their hands.

J. P. **Mealy Bug on Vines.**—*Gardeners' Chronicle, London*, lxiii, no. 1622, 26th January 1918, p. 40.

The author records a case of severe infestation of a vine with mealy bug [*Pseudococcus*] which was successfully dealt with by the application of gas-tar. The vines, which were in a weak state and had suffered from mildew, were first scrubbed with a mixture of soft soap (2 oz.) and sulphur (2 oz.) in a gallon of water, all the loose bark being cleaned off, especially round the spurs. The vinery was also scrubbed with soft soap and water and syringed with paraffin, wherever it could be used with safety, the walls being white-washed with hot lime. The vine stems were then painted with gas-tar mixture, freshly obtained from the gas-works, which was applied as a stiff paste to all parts except the eyes and last season's wood. Though the vine had not recovered in

appearance, the yield of grapes the next season was better than for the previous 20 years. The gas-tar method is therefore considered to be both cheaper and safer than fumigation with sodium cyanide.

RICHARDS (J. M.). **Mealy Bug on Vines.**—*Gardeners' Chronicle, London*, lxiii, no. 1624, 9th February 1918, p. 60.

Another method for the control of mealy bug [*Pseudococcus*] on vines that has given good results is as follows:—After pruning the vines, the houses should be thoroughly washed with carbolic soap and boiling water, a wineglassful of paraffin being added to each bucketful. The vines must then be scrubbed with very hot water, and all loose bark scraped off on to sheets of paper, which must then be burnt. Two more washings with nicotine soap and hot water are then given. After drying, the stems are painted with a mixture of clay, nicotine, soft soap and sulphur, of the consistency of paint, and the walls must be treated with a mixture of hot lime and paraffin.

TULLGREN (Albert). **Blyarseniat som Besprutningsvätska mot gnagande Insekter.** [Lead Arsenate as a Spraying Fluid against mandibulate Insects.]—*Sveriges Pomologiska Förenings Årsskrift*, häfte 2, årg. 18, pp. 113–116, 3 figs.

This paper gives an account of the properties and use of lead arsenate against *Cydia pomonella*, L., and *Argyresthia conjugella*, Zell.

TULLGREN (Albert). **Skadedjur i Sverige Åren 1912–1916.** [Injurious Animals in Sweden during 1912–1916.]—*Meddelande från Centralanstalten för Jorsbruksförsök*, no. 152; *Entomologiska Avdelningen*, no. 27, pp. 104.

The publication of these annual reports has been delayed for various reasons, so that the present one covers five years and briefly enumerates about 350 species. It has been drawn up by the Entomological Department of the Agricultural Experiment Station of Sweden in cooperation with about 550 correspondents throughout the country who send in regular reports concerning noxious insects.

Forficula auricularia, L., damaged ornamental plants, as well as barley, wheat and cabbage in various places. The withered heads of grasses, such as *Poa pratensis*, *Alopecurus geniculatus*, *Phleum pratense* and *Festuca rubra*, caused by thrips were very conspicuous in the north of Sweden in 1916. *Kakothrips pisivora* (*Physopus robustus*, Uzel), did great harm in Southern Sweden in 1912, reducing the crop of peas by 60–75 per cent.

Lygus spp. attacked *Chrysanthemum indicum*, the species most commonly found being *L. pabulinus*, Mey., *L. pratensis*, L., and *L. campestris*, L. In the summer of 1914 severe attacks by *Lygus* sp. were reported on turnips, potatoes, clover, etc. *Typhlocyba rosae*, L., was observed in several localities, chiefly on roses, and was successfully combated by spraying with quassia. In the south of Sweden *Psylla mali*, Schmbg., injured apple trees, spraying with carbolineum being effected against it, with complete success. *Trioza alacris*, Fl. (*lauri*, Targ.) has been found on imported laurels on several occasions.

T. viridula, Zett., did severe damage to carrots; the eggs are easily destroyed by spraying with 10 per cent. carbolineum. *Rhinocola aceris*, L., occurred at midsummer in enormous numbers on maples in one locality, causing defoliation. *Aphis pomi*, DeG., was very common in 1914, spraying with quassia being employed with success, when used early enough. *Aphis rumicis*, L., did some injury to beans and beets in 1914-1915. *Aphis gossypii*, Glov., is one of the most common pests of cucumbers. *Dentatus (Aphis) crataegi*, Kalt., has been recorded from apple trees in several localities. *Aphis (Siphonaphis) padi*, L., which did such great damage in 1911 to cereals in southern Sweden, was not recorded during 1912-1916. *Brevicoryne (Aphis) brassicae*, L., occurs chiefly in the south of Sweden. *Anuraphis (Aphis) farfarae*, Koch (*pyri*, Koch), attacked the leaves of pear trees, causing the formation of galls; in the autumn this species migrates to *Tussilago farfara*, on the roots of which it oviposits. *Hyalopterus arundinis*, L. (*pruni*, F.) is very common on plums, sloe and reed. *Siphocoryne ligustri*, Kalt., a species not previously recorded from Sweden, did great injury to privet, causing the leaves to drop at the end of July and the beginning of August. *Myzoides (Myzus) cerasi*, F., was also very common during 1914. *Rhopalosiphum lactucae*, Kalt. (often erroneously recorded as *R. ribis*, L.) has not been recorded previously as a pest of currants, but in 1915 it caused great injury to them. Red and white currants were mainly attacked, black currants usually escaping, or, when attacked, suffering very little. By the end of August the attack was over. The infestation did not recur in the following year, and it is suggested that the Aphids succumbed to starvation in the autumn of 1915, the currants being so badly damaged that no food was left for the sexual forms, which live on currant before depositing the winter eggs. The great abundance of *Sonchus* in the potato fields may have caused this outbreak, this plant being the alternative host of this Aphid. *Macrosiphum rosae*, L., was especially abundant during 1914. *Prociphilus xylostei*, DeG., occurred on cultivated species of *Lonicera*. Other Aphids recorded were:—*Myzus ribis*, L., *Aphis grossulariae*, Kalt., *Macrosiphum granarium*, Kirby (*cereale* Kalt.), *Acyrthosiphon (M.) pisi*, Kalt., *Chaitophorus aceris*, L., *Pterochlorus roboris*, L., *Phyllaphis fagi* L., *Eriosoma (Schizoneura) ulmi*, L. *Chermes* sp. injured nurseries, especially in the south of Sweden in 1912, about 200,000 2-4 year-old spruce plants being attacked at Fridhem. *Gossyparia (Eriococcus) spuria*, Mod., (*ulmi*, Sign.) was recorded from elm trees in two localities. *Pseudococcus citri*, Riss., occurred on vines and peaches in hothouses; *Aspidiotus hederae*, Vall., on ivy; *Lepidosaphes ulmi*, L., on apple, pear, limes, etc. and seems to be spreading; *Aulacaspis rosae*, Bch., on roses. *Eulecanium (Lecanium) corni*, Bch., (*persicae*, auct.) is very common in Sweden, attacking peaches, vine, pear, lilac, etc.; *Physokermes coryli*, L. occurred on plum and hazel.

Coleoptera. *Trogophloeus pusillus*, Grav., injured cucumbers, melons and *Chrysanthemum indicum*. *Blitophaga opaca*, L., and *Phosphuga atrata*, L., damaged beet and Cruciferous crops in many localities. Some swarms of *Melolontha melolontha* (*vulgaris*, L.) and *M. hippocastani*, F., were noticed in June 1912, though not so numerous as in 1908 and 1904. About 6,500 lb. of beetles were collected. In 1916 new swarms occurred, though less numerous than during 1912.

Swarms of *Rhizotrogus solstitialis*, L., occurred in May and the middle of July. *Serica brunnea*, L., occurred in very large swarms in June 1915, and defoliated all kinds of trees and bushes. *Phyllopertha horticola*, L., damaged the leaves and young fruit of fruit trees, especially in the vicinity of Kalmar, where it appeared in enormous numbers in 1914, swarming throughout the month of June. *Cetonia aurata*, L., and possibly also *C. floricola*, Hrbst., were recorded as injuring the young ears of rye. *Meligethes aeneus*, F., damaged seedling plants of turnips and cabbage all over the country. *Agriotes lineatus*, L., injured sugar beet, oats and barley, from 40 to 80 per cent. of the plants being killed on hundreds of acres. *Anobium striatum*, Oliv., caused injury in buildings. *Sitodrepa panicea*, L., injured the seeds of tomatoes. *Ptinus fur*, L., *P. raptor*, *Niptus hololeucus*, Fald., *Tenebrio molitor*, L., and *Tribolium navale*, F., have been reported doing damage to grain, etc. *Callidium violaceum*, L., occurred in newly built houses. *Phyllotreta nemorum*, L., *Haltica oleracea*, L., and *Psylliodes chrysocephala*, L., were all numerous during 1914 and 1915, whereas in 1916, when the rainfall was very great, only isolated attacks were reported. *Phyllotreta vittula*, Redt., injured wheat in the latter half of June. *Batophila rubi*, Payk., damaged raspberries; *Psylliodes chrysocephala*, L., and *Phyllotreta nigripes*, F., severely injured cabbages; *Chaetocnema concinna*, Marsh., occurred in great numbers on rhubarb; *Phytodecta viminalis*, L., and *Phyllodecta vitellinae*, L., occurred in plantations of basket willows; *Phaedon cochleariae*, L., injured horse-radish. *Galeruca tanaceti*, L., devastated turnips in some localities on Gotland in 1915-16, appearing at the beginning of July in millions and completely defoliating the plants; in 1916 this beetle also attacked turnips, potatoes, clover and various weeds. *Cassida nebulosa*, L., injured cabbage and turnips.

The following bark-beetles were recorded: *Scolytus rugulosus*, Ratz., on apple trees, *Myelophilus piniperda*, L., *M. minor*, Htg., *Dendroctonus micans*, Kug., *Hylastes opacus*, Er., *H. palliatus*, Gyll., *H. glabratus*, Zett., *Pityogenes chalcographus*, L., *P. bidentatus*, Hbst., *P. quadridens*, Htg., *Ips sexdentatus*, Boern., *I. typographus*, L., *I. acuminatus*, Gyll., *Ips proximus*, Eichh., *Anisandrus dispar*, F., and *Xyloterus lineatus*, Oliv.

Bruchus rufimanus, Boh., occurred in horse-beans; *Byctiscus betulae*, L., injured the leaves of pear and plum trees in many places, and *Rhynchites betulae*, L., attacked young birches (*Betula verrucosa* and *B. odorata*) at the beginning of the summer of 1916 to such an extent that the trees appeared to have been scorched by fire. *Apion apricans*, Hrbst., and possibly also *A. flavipes*, Payk., injured the shoots of young spruces; *Sitones lineatus*, L., damaged peas, beans, raspberries, etc. *Hylobius abietis*, L., injured young plants of spruce and pine from April to beginning of June. Larvae of *Otiorrhynchus sulcatus*, F., were reported injuring raspberries, and *O. raucus*, F., gnawed the bark of the young shoots of currants, hazel and dwarf fruit trees. *O. singularis*, L., (*picipes*, F.) has not been previously recorded in Sweden, but in 1912 injuries caused by this weevil were reported on currants and other plants. *Phyllobius pyri*, L., and *P. maculicornis*, Germ., were very common in 1912 in the southern part of the country. Fruit trees were much injured, in May and the first half of June, especially pears, the buds of many

being so damaged that the trees succumbed. Spraying was quite useless, the only effective method being to collect the beetles. *P. oblongus*, L., was very common in 1912 injuring the plum trees in nurseries. In 1912 *P. viridicollis*, F., was recorded injuring roses. *Polydrusus flavipes*, DeG., occurred on fruit trees. *Hypera* (*Phytonomus*) *variabilis*, Hbst., not recorded since 1903, attacked lucerne in July in some localities in Scania. *Pissodes validirostris*, Gyll., attacked pine cones. *Anthonomus pomorum*, L., was more common during 1913 than in the other years. It was observed that on trees with rough and mossy covered bark 60-70 per cent. of the buds were attacked, whereas on trees with smooth bark only 5-10 per cent. were destroyed, suggesting that the former afford especially good hibernating quarters for the weevils. *Anthonomus rubi*, Hbst., destroyed a large percentage of the raspberries and strawberries in many localities. *Balaninus nucum*, L., was very common on cultivated hazel, and another weevil, probably *B. glandium*, Marsh., destroyed beechnuts. *Rhynchaenus* (*Orchestes*) *fagi*, L., was very common on beeches; *Cryptorrhynchus lapathi*, L., injured basket willows; *Ceuthorrhynchus rapae*, Gyll., destroyed 10 per cent. of the cabbage plants in one locality, and *C. quadridens*, Panz., attacked turnips. *Calandra granaria*, L., seems to be widely spread in the south of Scania, being evidently capable of hibernating indoors. *C. oryzae*, L., was found in maize imported from Argentina.

Lepidoptera: *Aporia crataegi*, L., injured apples, pears, mountain ash, willow, etc. in several localities, the attack increasing from 1912 to 1915. *Pieris brassicae*, L., was very numerous in 1911 in Scania, but owing to the unfavourable climatic conditions, it did very little harm in 1912. In the south of Sweden three generations a year probably always occur, though in the north there are only two. *P. rapae*, L., injured turnips and cabbages. *Vanessa io*, L., and *V. urticae*, L., were found on hops; *V. polychloros*, L., on apple, pear and cherry; and *V. antiopa*, L., on willow. *Sphinx ligustri*, L. occurred on apple. *Phalera bucephala*, L., was present in great numbers in 1913 on cultivated oak, beech and lime in several localities. *Orgyia antiqua*, L., was reported as doing damage to apples and plums. *Stilpnotia salicis*, L., was common on birch, aspen and willow. In 1915-1916 large plantations of willows and poplars were badly injured by the larvae in June. *Lymantria dispar*, L., defoliated birches in one locality, and *L. monacha*, L., was observed swarming at the beginning of July. *Malacosoma neustria*, L., was very common in southern Sweden in 1915 and 1916. *M. castrensis*, L., attacked raspberries at the end of May. *Trichiura crataegi*, L., was found on plum trees in the middle of June. *Eriogaster lanestris*, L., was especially numerous in 1912, attacking apple, pear, plum and cherry and many forest trees. *Dendrolimus pini*, L., was found on pine trees. *Agrotis* spp. were recorded from rye, wheat, potatoes, carrots, turnips, cabbage, beans, and other plants. *Euxoa* (*Agrotis*) *vestigialis*, Rott., destroyed young spruce. *Euxoa* (*Agrotis*) *corticea*, Hb., and *E.* (*A.*) *nigricans*, L., were reported injuring cabbage. *Charaeas graminis*, L., which formerly did great damage in the northern coast districts, has been rather scarce of late years. *Barathra* (*Mamestra*) *brassicae*, L., and *Polia* (*M.*) *oleracea*, L., severely injured cabbages in 1914, destroying 10,000 plants in one locality alone. *Luperina* (*Apamea*) *testacea*, Kb., not previously

recorded as injurious in Sweden, damaged pastures. *Hydroecia micacea*, Esp., injured potatoes, sugar-beet and raspberries. *Panolis flammea*, Schiff. (*griseovariegata*, Goeze), occurred on pines. *Eupsilia (Scopelosoma) satellitia*, L., was reported on fruit trees, birch and turnips. *Hypena rostralis*, L., attacked hops at the beginning of August 1916. *Cheimatobia brumata*, L., was especially numerous in 1912. *Larentia nebulata*, Thnb., a species that periodically defoliates the birches in the alpine parts of Sweden and Norway was very abundant at Tärna in the middle of July. *Chloroclystis rectangulata*, L., was recorded from fruit trees in several localities. *Abraxas grossulariata*, L., injured gooseberries and red currants. The larvae of *Himera pennaria*, L., appeared on apple trees at the end of May. *Hibernia defoliaria*, Cl., was most common during the same years, 1912 and 1913, as *Cheimatobia brumata*. *Amphidasys betularia*, L., was found on apples. *Bupalus piniarius*, L., damaged pine trees severely in 1912. *Nola cucullatella*, L., injured young fruit trees, gnawing off the bark of the young twigs and shoots; in 1916 a number of young Cox's Orange pippins were killed in this manner. *Aegeria apiformis*, Cl., destroyed young balsam poplars in 1916. *Paranthrene tabaniformis*, Rott., injured young poplars in nurseries. The larvae of *Pennisetia (Bembecia) hylaeiformis*, Lasp., were common on raspberries in 1916. *Cossus cossus*, L., was reported injuring apple, ash, alder, maple, birch, poplar and willow. *Zeuzera pyrina*, L., injured apple trees and lilac. *Achroia grisella*, F., was numerous in bee-hives in 1915, and *Galleria melonella*, L., also did a great deal of damage. The larvae of *Ephestia kühniella*, Z., destroyed dried vegetables. *Zophodia convolutella*, Hb., was very numerous in southern Sweden in 1915, often destroying one-third of the crop of gooseberries. *Pionea forficalis*, L., injured turnips and cabbage, especially in 1914. *Tortrix bergmanniana*, L., injured roses at the beginning of June. *T. viridana*, L., nearly defoliated the oaks at Borgholm in 1915-1916. *T. paleana*, Hb., injured timothy at the beginning of June in 1916. *Cnephasia wahlbomiana*, L., occurred on strawberries. *Exapate congelatella*, Cl., damaged gooseberries, apples, hawthorn, mountain ash and *Cytisus laburnum*. *Rhyacionia (Evetria) buoliana*, Schiff., injured the shoots of young pine trees in many localities. *Argyroploce variegana*, Hb., and *Eucosma (Tmetocera) ocellana*, F., were most numerous during 1915, chiefly attacking apple. Injuries probably caused by *Enarmonia prunivora*, Wlsh., were reported from several localities. *Eucosma (Notocelia) roborana*, Tr., injured roses, in some places as many as 75 per cent. of the shoots being attacked. *Enarmonia (Epinotia) binotana*, Wck., a species new to Sweden was found in the buds of *Abies pectinata* in 1916. *Cydia (Carpocapsa) pomonella*, L., was very numerous in 1914, destroying in many localities 50 per cent. or more of the crop. *C. (Grapholitha) funebrana*, Tr., did great damage to plums in 1912-1914. *C. (Grapholitha) nigricana*, Stph., was especially abundant in 1912 and 1913 destroying from 15 to 70 per cent. of the crop of peas. *Hemerophila (Simaethis) pariana*, Cl., was reported from many localities in the south of Sweden, no great harm being, however, done; the larvae of the first generation occurred from the middle of May to the middle of June, those of the second generation in July and the beginning of August. *Sitotroga cerealella*, Oliv., occurred in imported maize in 1915. *Gracilaria syringella*, F., injured

lilac, privet and ash. *Lyonetia clerkella*, L., was very numerous in southern Sweden, attacking the leaves of apple. *Scythropia crataegella*, L., was reported from hawthorn, apple, and pear. *Hyponomeuta euonymellus*, L., attacked bird-cherry trees in many parts of Sweden in 1915, and in the same year *H. malinellus*, Z., was also reported from many places. *Argyresthia conjugella*, Z., did great damage in 1916. During previous years there had been an abundance of berries on the mountain ash, which favoured the increase of this moth, but in 1916 these trees did not bloom at all, compelling this pest to attack apples. *Argyresthia ephippiella*, F., was very numerous in the buds of cherry trees. *Plutella maculipennis*, Curt., attacked cabbage in southern Sweden in 1914. *Tinea granella*, L., destroyed rye, wheat, peas and clover-seeds. *Incurvaria capitella*, Cl., recorded for the first time from Sweden in 1910, did great damage to red currants.

Diptera. Larvae of *Tipula* sp. attacked young pine trees in 1914, gnawing off the bark below the surface of the earth. *Sitodiplosis* (*Clinodiplosis*) *mosellana*, Geh., (*aurantiaca*, Wagn.) was observed on barley. *Contarinia pyrivora*, Ril., was very numerous in 1912, in many places destroying nearly the whole crop of pears. *Contarinia pisi*, Winn., was abundant in the vicinity of Upsala in 1915. *Contarinia tritici*, Kirby, has been reported from several localities. *Stenodiplosis geniculatus*, Reut., occurred in the seeds of foxtail, about 57,000 larvae being present in one pound. *Perrisia* (*Dasyneura*) *pyri*, B., attacked the foliage of pear trees. *Perrisia* (*Dasyneura*) *flosculorum*, Kieff., occurred in clover seeds. *Phytomyza affinis*, Fall., and *P. geniculata*, Macq., attacked the leaves of cultivated chrysanthemum. *Hydrellia griseola*, Fall., attacked oats and timothy grass. *Oscinella frit*, L., damaged oats, barley and wheat in many places. *Siphonella pumilionis*, Bjerk., was reported injuring barley and wheat. *Meromyza cerealium*, Reut., caused withering of oats. *Psila rosae*, L., injured parsnips, parsley and dill. *Amaurosoma armillatum*, Zett., and *A. flavipes*, Fall., have been reported injuring the spikes of timothy grass. *Chortophila brassicae*, Beh., injured cabbage, turnips and swedes in many parts of the country. *Pegomyia hyoscyami*, Pz. (*conformis*, Fall.), injured sugar-beet, common beet and spinach. *Hylemyia antiqua*, Meig., was especially numerous on onions in 1916. *H. coarctata*, Fall., injured wheat and rye in some places. *Merodon equestris*, F., injured the bulbs of daffodils. *Aphiochaeta pygmaea*, Zett., attacked the seeds of pumpkins.

Hymenoptera. *Eriocampoides* (*Caliroa*) *aethiops*, F., injured the leaves of roses and *E. limacina* those of pear and cherry trees in many localities. *Hoplocampa testudinea*, Klg., attacked young apples and *H. minuta*, Christ, did great injury to plums, the loss in some places amounting to 50-75 per cent. of the crop. *Ardis bipunctata*, Klg., seems to occur wherever climbing roses are cultivated. *Blennocampa pusilla*, Klg., injured roses, and *B. geniculata*, Htg., in 1915 attacked strawberry plants. *Croesus septentrionalis*, L., occurred in great numbers on birches and poplar. *Lygaeonematus* (*Nematus*) *erichsoni*, Htg., defoliated larch trees in several localities. *Holcocneme* (*Nematus*) *coeruleocarpa*, Htg., attacked poplars and *Pteronus* (*Pteronidea*) *ribesii*, Scop., currants and gooseberries in many places, especially in 1916. *P. salicis*, L., defoliated *Salix fragilis*. Spruces from eight to ten years old were injured probably by *Lygaeonematus saxeseni*, Htg.,

in 1912. *Lygaeonematus laricis*, Htg., occurred in great numbers on young larches. Larvae, probably those of *L. compressicornis*, F., were found on young aspen. *Pristiphora pallipes*, Lep. (*appendiculata*, Lep.), probably a common species on gooseberry, was only reported from three localities. *Arge rosae*, L., injured roses though it only attacked Liberty and to a smaller extent Caroline Testout, other varieties escaping injury. *Acantholyda hieroglyphica*, Christ, injured young pine trees at the end of July and the beginning of August in several localities in the north of Sweden. *A. stellata* injured 2-year-old pine trees.

Myriopoda. *Blaniulus guttulatus*, Gerv., has been reported injuring the seeds of beans, peas and pumpkins, and *Polydesmus complanatus*, L., damaged ornamental plants.

Acari. *Paratetranychus ununguis*, Jac., attacked young spruce trees, but the majority of the reports concerning spinning mites record injuries caused in hothouses by *P. althaeae*, v. Hanst.; *P. pilosus*, C. & F., occurs commonly on apple and plum trees; *Tetranychus telarius*, L., attacked elms; *Bryobia praetiosa*, Koch, injured gooseberries in some localities. The following mites were also recorded: *Tarsonemus spirifex*, March., on oats; *Pediculoides graminum*, Reut., on timothy and other grasses; *Rhizoglyphus echinopus*, F. & R., on oats, barley and wheat; *Eriophyes pyri*, Pgst., on pear; *E. malinus*, Nal., *E. similis*, Nal., *E. ribis*, Nal., and *E. vitis*, Nal.

Akerman (A.). **Några iakttagelser rörande Härjningar av Vetemygglarver å Höstvetet Sommaren 1916.** [Some Observations on the Injury caused by the Wheat Midge (*Contarinia tritici*, Kirby) on Autumn Wheat in the Summer of 1916.]—*Svenska Utsadesforeningens Tidskrift*, årg. xxvii, h. 1, 1917, pp. 24–33.

Contarinia tritici is one of the most injurious pests of wheat in Sweden, often reducing the crop by 5-10 per cent. and sometimes, as in Gotland, destroying about 66 per cent. of the grain. At Svalöv, where the present observations were made, serious damage was done in the years 1901, 1903, 1905, 1912 and 1916, especially during the last, when not only autumn wheat but also spring wheat and barley were attacked. The investigations were conducted with a view to obtaining reliable records of the extent of the injury caused to the different varieties of wheat.

Ovipositing females were observed for the first time on the 24th of June; oviposition continued for a comparatively long time, egg-laying females occurring as late as on the 11th of July. The first larvae were found in the middle of July, and at the end of the same month they occurred in such numbers on the varieties most injured that the ears were yellow. The examination of the different varieties showed that the loss of grain varied between 2·2 and 33 per cent., the earlier varieties being most injured, this being due to the fact that their ears emerged exactly at the time when the greatest number of midges occurred. Varieties in which the ears emerged later were far less damaged. The varieties most injured had pubescent ears, and this seemed to justify the conclusion that these forms were more exposed to attack than those with glabrous ears. This, however, on further investigation was found not to be the case. The protection

enjoyed by the latter varieties is, however, only relative, because the climatic conditions may retard the development of the midges so that they appear in the greatest number when the ears of these varieties make their appearance. The loss caused during years of comparatively severe infestation is estimated to equal about 5 per cent. of the crop of the whole country or about £111,000.

TEDIN (Hans). **Skada av Vetemygglarver på Tvåradskorn 1916.** [Injury caused by the Wheat Midge on two-rowed Barley.]—*Svenska Utsadesföreningens Tidskrift*, årg. xxvii, h. 1, 1917, pp. 34–42.

Injury caused by *Contarinia tritici*, Kirby, on two-rowed barley was observed for the first time in Scania in 1912, the attack being then probably spread over the greater part of the county. The attack was repeated in 1913, but was then more local. Of the 42 different varieties of barley cultivated 21 had the ears visible on the 18th of July, of the other half the ears emerged during the 19th–27th of the same month. Of the former, 16 varieties had 10 per cent. or more of the grain destroyed, whereas in the latter only 4 exhibited such high percentages, the rest having far less. This is explained by the fact that the midge was most numerous when the ears of the earlier varieties emerged and they preferably oviposit on the newly emerged ears. The average percentage of injured grain was about 8·8, equalling a loss of about 240 lb. per acre.

RORER (J. B.). **Cacao Spraying Experiment, 1916–1917.**—*Bull. Dept. Agric. Trinidad & Tobago, Port of Spain*, xvi, no. 3, 1917, pp. 165–167. [Received 1st February 1918.]

A spraying experiment undertaken to test the value of a combination of Bordeaux mixture and nicotine sulphate as a control measure for *Phytophthora* or black rot of cacao pods and for thrips [*Heliothrips rubrocinctus*] is here described.

For this purpose a field previously badly infested was divided into three plots, only one of which was sprayed. The solution was composed of 5 lb. bluestone, 5 lb. lime to every 41½ gals. of water, to which was added 5½ oz. of Black-leaf 40, and this was applied three times: on 23rd August, when the trees were well covered with young and adult thrips that were ovipositing; on 14th September, chiefly for the purpose of protecting the young fruits from black rot; and lastly, on 19th October. By the middle of November the difference between the sprayed and unsprayed trees was apparent, the latter being almost defoliated, while the former remained in full foliage and produced a very good crop. It was proved that every spraying more than pays for itself, even if the trees are only sprayed once.

TAYLOR (H. W.). **Tobacco Seed-beds.**—*Union of S. Africa Dept. Agric., Pretoria*, Bull. no. 7, 1917, 12 pp., 2 figs.

The larva of the tobacco split-worm [*Phthorimaea operculella*] attacks either the stem or leaf; in the former case it eats out the interior, causing a gall-like injury that renders the plant useless and necessitates its being pulled up and destroyed. If the leaf is attacked, the

caterpillar burrows between the two surfaces, though it does not remain in one leaf, but attacks two or more, giving an opportunity for control by spraying with lead arsenate at the rate of 1 lb. to 16 gallons water. The plants should be sprayed thoroughly once a fortnight from the time that the leaves are the size of a shilling until the plants are transplanted in the field. Attacks may he prevented by enclosing the seed-beds with boards and covering with cheese-cloth until a fortnight before the seedlings are transplanted, one application of lead arsenate being sufficient to prevent injury during this period.

JACK (R. W.). **The Maize Stalk Borer (*Calamistes fusca*, Hmpsn.)**—*Rhodesia Agric. Jl., Salisbury*, **xiv**, no. 6, December 1917, pp. 707–717, 2 plates.

The maize stalk borer is the caterpillar of a Noctuid moth, *Busseola (Calamistes) fusca*, that oviposits during the month of December between the leaf-sheath and the stalk of plants that have attained a certain size, usually about 12 inches in height. There are two broods during the year, the moths of the first emerging in late November and early December, and of the second about the end of February. The larvae of the second hrood hore into the stalks of maize, kaffir corn and allied crops, and hibernate there, often as far down as the roots.

Planting should not be done too early. This will avoid the plants being of the requisite height at the time that the moths are on the wing. The stalks, which must be hoed out or cut below the soil level during the winter, should be burnt.

SAVAGE (C. G.). **The Cabbage Aphis (*Aphis brassicae*).**—*Jl. Dept. Agric. S. Australia, Adelaide*, **xx**, no. 7, February 1917, p. 581. [Received 2nd February 1918.]

The growing of cabbages and cauliflowers would be difficult in some districts owing to the attacks of the cabbage aphis (*Aphis brassicae*), were this insect not heavily parasitised by a small Ichneumonid that keeps it in check. The best preventive against the Aphid is rapid forced growth by manuring the soil before planting, and then freely watering the plants, or watering with small quantities of sodium nitrate, ammonium sulphate and soot. Should the Aphid have become established, the best treatment is spraying with water at 120°F., while sprays of tobacco wash, resin wash, or kerosene emulsion may be used, if applied before the cabhage-heart forms. If young plants hecome infested while still in the seed-bed, they should be dipped in one of the ahove mixtures before transplanting.

RITCHIE (W.). **The Structure, Bionomics and Forest Importance of *Myelophilus minor*, Hart.**—Separate, dated 4th December 1917, from *Trans. R. Soc. Edinburgh*, lii, part 1, no. 10, 1917, pp. 213–234, 2 plates.

This paper describes the life-history, habits, and important anatomical features of *Myelophilus minor*, Hart., and contrasts them with those of *M. piniperda*, the only other species of this genus that is a

native of Britain. The formation of the brood-galleries of *M. minor*, which is described in detail, has already been dealt with in a previous paper [see this *Review*, Ser. A, iv, p. 47.]. The length of the life-cycle varies according to the season, the temperature and conditions of nutrition. In Central Europe the duration is given as 75 to 84 days; in Scotland the author observed a life-cycle of 95 days. While *M. minor* breeds in weakened stems, the author has not found it breeding in stumps, where *M. piniperda* breeds freely. The host-trees of *M. minor* in Continental forests include several species of pine; in Scotland the author has found it only in Scots pine. The question of the number of annual generations or broods of *M. minor* has given rise to some discussion; the author's observations have led him to conclude that in Scotland the occurrence of a third annual generation is impossible, but that there may be two broods a year. A proportion of the adult beetles, after laying the eggs from which the first brood will develop, leave the parent-galleries and return to the young pine shoots at the top of the tree, and after a nutritious diet a second oviposition period may follow in a newly made mother-gallery. It is possible that from this second series of eggs a second issue of adults may take place within a year. The same process was obtained experimentally with adults of *M. piniperda*.

Both *M. minor* and *M. piniperda* are dangerous enemies of the pine and sometimes cause the death of the tree. The periods of greatest damage are from mid-August onwards and from late June onwards; during each of these periods the adults are feeding on the young shoots prior to oviposition. Additional damage is done in boring the mother and larval galleries. The increase of *M. minor* may be checked by the use of trap-trees. These should be standing trees selected at intervals throughout the wood, and their use should be continuous from March to October. At regular intervals these traps should be felled and the bark removed and destroyed; this must be done before the larvae become full grown. Natural enemies of these two species include a Clerid beetle, *Clerus formicarius*, L., which in both the larval and adult stages is predaceous upon larvae, pupae and adults. The Nitidulids, *Rhizophagus ferrugineus*, Payk., *R. depressus*, F., and *Pityophagus ferrugineus*, F., as well as *Glyschrochilus* (*Ips*) *quadripustulatus*, L., at times completely clear the galleries of eggs. A small Staphylinid beetle effects similar depredations. A Neuropteron, *Rhaphidia* sp., is another enemy of the eggs, while a Hymenopterous parasite is found feeding externally as a larva on the larvae and pupae of both species. *M. minor* seems to be almost immune to fungus attack, but *M. piniperda* breeding on the stumps of felled trees is largely destroyed by fungus mycelia.

STEVEN (H. M.). **Contributions to the Knowledge of the Family Chermesidae, No. i; the Biology of the *Chermes* of Spruce and Larch and their Relation to Forestry.**—Separate, dated 13th June 1917, from *Proc. R. Soc. Edinburgh*, xxxvii, part iii, no. 21, pp. 356–381. [Received 5th February 1918.]

This paper records an introductory research on Aphids of the genus *Chermes* and their allies, which have already been extensively studied on the Continent in recent years [see this *Review*, Ser. A, v, p. 592],

though they have received but little attention in Britain. The nomenclature of the generations is discussed in detail. A history of previous research on the species of *Chermes* is given and the technique employed by the various workers on this group in conducting their experiments is described. Recent experiments in Britain were carried out in a small wood at Drumshoreland, West Lothian, which contained *Picea excelsa, P. alba, P. nigra, Larix europaea, L. leptolepis, Pinus sylvestris, Pseudotsuga douglasi* and hardwoods. The age of the trees varied from 5 to 50 years.

Chermes (s. str.) was found on the following hosts in Scotland:—Primary or *Picea* host: *Picea excelsa, P. alba, P. orientalis, P. morinda, P. sitkensis.* Intermediate or non-*Picea* host: *Larix europaea, L. leptolepis, L. occidentalis.*

Two separate cycles have been proved to be present in Britain: (1). A cycle of two generations, fundatrix and gallicola non-migrans; these both lay yellow eggs on spruce, and the galls open over an extended period from the end of July until mid-September. This is the species *Chermes abietis,* Kalt., of Cholodkovsky. (2). A cycle of five generations, fundatrix, gallicola migrans, colonici, sexupara, and sexuales. The fundatrix lays green eggs on spruce, and the gallicola migrans lays very dark green eggs on larch. The galls open during a limited period in the first half of August. This is the species *Chermes viridis,* Ratz., of Cholodkovsky. There is probably a cycle with both gallicola migrans and non-migrans corresponding to *Chermes abietis,* L., of Börner, or *Chermes occidentalis,* Chol. Sistens and progrediens larvae hatch from the eggs laid by the colonici. Many of the sistens larvae do not settle down on the bark, but migrate to the needles and die.

The genus *Cnaphalodes* was found on the following hosts in Scotland: Primary or *Picea* host: *Picea excelsa, P. orientalis, P. alba, P. sitkensis.* Intermediate or non-*Picea* host: *Larix europaea, L. leptolepis, L. occidentalis.*

Two separate cycles have been shown to be present in Britain: (1) A cycle of two generations, fundatrix and gallicola non-migrans. The latter lays bright orange-coloured eggs under the protection of a copious woolly covering. The galls open over an extended period from the end of July until the end of September. This is the species, *Chermes lapponicus,* Chol., var. *tardus,* Dreyfus, of Cholodkovsky. (2). A cycle of five generations, fundatrix, gallicola migrans, colonici, sexupara and sexuales. The gallicola migrans lays dark bronze-coloured eggs without any woolly covering on larch. The galls open during a limited period in the first half of July. This is the species, *Chermes strobilobius,* Kalt., of Cholodkovsky. Sistens and progrediens larvae hatch from the eggs laid by the colonici and progredientes of *Cnaphalodes strobilobius,* Kalt. The relative proportion of each type is variable. It has thus been shown that the above cycles are not confined to North and East Europe, where larch is either absent or the European species is replaced by *Larix sibirica,* but are present in Britain, where larch and spruce grow side by side.

On his experimental area the author estimates that 90 per cent. of the species of *Chermes* and *Cnaphalodes* on spruce were the non-migrating, parthenogenetic species, although the branches of the spruce and the larch were often interlocked. This fact suggests that the

non-migrating species have not arisen because the intermediate host larch was absent, but because they are the more successful species even when spruce and larch are both present. The question whether the above cycles should be considered as those of separate species or of biological races of one species can only be determined by further research, both morphological and biological. Statistical research will be important in determining this question.

In investigating the relation of these genera to forestry, the methods of infestation were found to be the same in both *Chermes* and *Cnaphalodes.* Conditions favouring infestation are proximity of the hosts and favourable weather conditions. These explain the rapid spread of the pest in forest nurseries, which are usually sheltered, with the trees crowded together.

Spruce is infested from two sources:—(*a*) by sexuparae. The parthenogenetic adaptations on larch are made at the expense of the sexupara generation. Thus on the area under observation, although colonici were very numerous on larch, the number of sexuparae attaining maturity, and still more those reaching spruce and laying eggs, was small. Thus infestation from that source is not serious. (*b*) By gallicolae non-migrantes. The majority of such gallicolae settled on the tree on which they were born. This, together with the high fertility of the two generations constituting that cycle, caused the rapid increase on the host. Infestation from this source is therefore serious.

Larch is infested by gallicolae migrantes. This is the source of the first infestation, but the species are thereafter principally continued on this host by the parthenogenetic adaptations.

Damage to spruce by *Chermes.* The species of this genus attack strong growing spruce, hence the damage is primary. Under normal conditions such damage is unimportant, but when allied with unsuitable soil or atmospheric conditions, the work of this genus may play an important part in killing the host. On the area under observation the generations of the non-migrating species did much greater damage. The species of *Cnaphalodes* attack only thin shaded branches, hence the damage, as regards spruce, is secondary. Shaded spruce, however, are quickly killed, as the galls terminate the twigs. Thus the damage would be important where, in thinning a wood, the shaded spruce were left for soil protection. As before, the non-migrating species was found to be more dangerous.

The damage to larch by the species of the two genera *Chermes* and *Cnaphalodes* has undoubtedly been greatly increased by the planting of that conifer in localities and under conditions very different from those of its natural habitat, with a consequent weakening of the tree. The species of both genera are usually present on the same tree. *Chermes* is principally a bark-feeder as regards larch, hence the damage is difficult to estimate. Frequently the bark is whitened by the "wool" and cast skins of the colonici; later the bark turns black. The feeding of these numerous colonici, at a time when growth should be at a maximum, must have a weakening effect on the host. The punctures are small, but they are made at a time when girth is increasing, so that they will be greatly increased in size and become a possible means of infection by parasitic fungi. The damage resulting from the feeding of the sexuparae is unimportant, as its duration

is short. *Cnaphalodes* is a twig- and leaf-feeder on larch. The colonici do damage similar to that by colonici of *Chermes*. In the author's opinion the principal damage is done by the progredientes. They are frequently so numerous as to whiten the larch needles. To repair the damage, the dwarf shoots and dormant buds begin to grow. These, together with the elongating terminal shoots, provide new and succulent food for the succeeding generations of progredientes. Thus the struggles of the host to free itself only result in its more complete subjugation.

The non-migrating species of *Chermes* and *Cnaphalodes* are more serious enemies to spruce than are the migrating species. The CHERMESIDAE, however, are serious enemies of spruce only when allied with unsuitable soil or atmospheric conditions. The collective damage to larch by the colonici of *Chermes* and *Cnaphalodes* and the progredientes of *Cnaphalodes* is serious in Britain.

The marked parthenogenetic developments of the species of *Chermes* and *Cnaphalodes* on both spruce and larch make it useless to eliminate either host from any particular plantation. As *Chermes* quickly increase in the event of any decline in the health of their hosts, great care should be taken that the planting area is clearly suitable to the conifer which it is desired to plant. The author is convinced that there is no practical method of controlling these pests after a plantation has been formed. His observations lead to the conclusions that these Aphids are frequently widely present in forest nurseries, and that they often seriously damage their hosts immediately after a plantation has been formed. Thorough fumigation of the nursery stock immediately before despatch to the planting area is therefore strongly advocated. A table is given showing the results of fumigation with hydrocyanic acid gas, nicotine and carbon bisulphide, and their effect is discussed. Hydrocyanic acid gas, generated from potassium cyanide at the rate of 1 oz. to 100 cub. ft. of space, or from sodium cyanide, 1 oz. to 130 cub. ft. of space, is apparently the most useful fumigant, and the process proves to be a safe, efficient and inexpensive method of killing Chermesids on nursery stock. Fumigation should be done not later than 1st April, as the insects begin to oviposit after that date. The temperature at which fumigation was successful proved to be much lower than that considered the optimum; this is important, as the average air temperature at the time when fumigation must be carried out is low. The methods of fumigation described in these experiments will probably require elaboration in practice, but this control should prove of special value in this country at this time, as very extensive planting of conifers will have to be carried out in the years following the close of the War.

Various theories have been suggested as to the origin of migration. Early authors were agreed that spruce is the original host of Chermesids; Cholodkovsky considers the cycle to be an annual one and on spruce only [*loc. cit.*], sexuales being produced towards the end of summer and the winged forms transported by wind to trees of other genera, where they adapted themselves to feeding and breeding. The migration back to spruce then took place in a similar way to the first migration. Börner in 1907 introduced the theory that the *Picea* host was intermediate, pine being the primary host. This theory was later abandoned for that of Mordwilko, who considers that all Aphids were

originally polyphagous and that the present migrations are remnants of that ancestral condition. The relative suitability of the hosts as regards food and breeding is the impulse inducing any particular migration. He divides modern Aphids into groups on the following lines :—

A. A group in which there are no real migrations; two different host-plants are not necessary, but the species are widely polyphagous. Here come numerous APHIDINAE, some LACHNINAE and SCHIZONEURINAE.

B. A group in which there is facultative migration; two host-plants may be utilised, while the polyphagism of the species is limited; e.g., *Siphocoryne xylostei*, Schr., according to Mordwilko, can complete uninterruptedly its life-cycle on honeysuckle. The portion from the first winged parthenogenetic females to the sexuparae and the winged males can, however, be passed on an umbelliferous host.

C. A group in which migration is obligatory; two host-plants are necessary, while the species are only slightly polyphagous. Here come a few APHIDINAE, some SCHIZONEURINAE and PEMPHIGINAE. Here also come the species of *Chermes*.

Mordwilko's theory is based on wide data, but assumes that the same phenomena within this diverse group (Aphids in its widest sense) arose in the same way. All the species of CHERMESIDAE that possess a sexual generation pass that generation on spruce. On the other hand, the parthenogenetic development has arisen on a number of other genera of conifers. In the author's opinion the early theories of spruce as the original host of Chermesids explain this phenomenon more satisfactorily.

MACDOUGALL (R. S.). **Insect and Arachnid Pests of 1916.**—*Trans. Highland & Agric. Soc. Scotland*, 1917, pp. 1–38, 39 figs. [Received 5th February 1918.]

The various insects injurious to agriculture or agricultural products dealt with in this paper include *Magdalis phlegmatica*, Hbst., of which very little is known. The weevil oviposits on the tops of old pine and spruce trees, and the larvae upon hatching gnaw a gallery below the bark, penetrating sometimes into the pith; here pupation takes place, the adult eating its way to the outside. *Myelophilus* (*Hylurgus*) *piniperda* (pine beetle) has been observed on pine, spruce and larch. The breeding habits and damage caused by this beetle are very similar to those of the allied species *M. minor* [see this *Review*, Ser. A, vi, p. 153]. The Scolytid, *Cryphalus abietis*, occurs on spruce (*Picea excelsa*) and on noble silver fir (*Abies nobilis*). Two species of *Megastigmus* have been reared from cones of silver fir and larch. *Perrisia* (*Cecidomyia*) *strobi* oviposits in young spruce cones, and the larvae feed on the seed and pupate in the cones under cover of a very delicate cocoon. An unidentified Cecidomyid infests larch cones, while the buds are also frequently injured by a Cecidomyid larva. It is hoped to rear the adults of these. *Cydia* (*Tortrix*) *strobilella*, L., oviposits on the scale of spruce cones in May and June, and the larvae on hatching pass to the centre of the cone and eat into the axis, destroying it before it has hardened. The whole life-cycle is passed within the cone, the larvae feeding during summer and early autumn,

hibernating in the cone and pupating late in the next spring. The pupae push themselves out between the scales before the adults emerge. Infested cones appear shrunken and show an exudation of resin. The damage done by this species is contrasted with that of *Dioryctria abietella.*

Scolytus multistriatus (small elm bark-beetle) gnaws a longitudinal gallery in the cambium of sickly elm trees, cutting notches along the sides of the gallery for the eggs. The larvae tunnel at right-angles to the parent-gallery in the bark or outermost wood rings. Pupation takes place in the bark, the adults issuing through shot-like exit holes. In conjunction with *S. destructor* this beetle may effect considerable damage. The larvae of the Tineid, *Phyllorycter* (*Lithocolletis*) *messaniella*, mine in the leaves of broad-leaved trees such as oak, and holm oak (*Quercus ilex*), causing pale-coloured blotches on the dark leaves. *Sirex gigas* (giant wood wasp) oviposits in spruce and silver fir and sometimes in pine and larch. *Sirex noctilis* (steel-blue wood wasp) usually oviposits in pine, but sometimes in spruce and silver fir. The galleries made by the larvae spoil the wood for technical purposes. Felled or broken trunks should not be left lying about, as they are used for breeding and act as centres from which these wasps pass to standing trees. *Enarmonia woeberiana* (cherry- and plum-tree borer) oviposits near the base of the trunk and the larvae feed on the bast of peach, cherry and pear trees and on the decorative plant, *Pyracantha lelandi*, causing the dying-off of the infested branch or stem. *Lepidosaphes ulmi* (apple mussel scale) infests apples and other rosaceous fruit-trees, and many shrubs and trees. *Abraxas grossulariata* (gooseberry and currant moth) is injurious in April and May, the larvae stripping the bushes of their leaves, and attacking also blackthorn, hazel and *Euonymus*. The caterpillars hibernate and complete their development in the following spring. It is in their early stage, when they feed for a short time only, or when they are hibernating under leaves spun together or in the litter below their food-plants or in cracks in walls, that this pest can be fought with some success. The plants should then be pruned and the cuttings burnt; the ground below should be dug deeply after a dressing with powdered quicklime; loose leaves should be collected from the bushes. Lead arsenate spray will poison the larvae, but should not be used within 4 weeks of the fruit being picked. Ichneumonids and Tachinids are both parasitic on these caterpillars, while cuckoos are apparently the only birds that can devour them with impunity. *Pteronus* (*Nematus*) *ribesii* (gooseberry sawfly) oviposits in April and May on the leaves of gooseberry; the eggs hatch in a week, and after a month of feeding the caterpillars descend to the ground and pupate beneath the surface, the adults emerging about 3 weeks later. The cocoons of the next generation lie in the soil through the winter, adults emerging from these in April or May. Lead arsenate spray is recommended, or a mixture of hellebore 1 oz. and water 3 gals., the spray requiring constant agitation as the hellebore does not dissolve in water. Two ounces of flour may be added to aid adhesion. Hellebore and fine soot can be scattered along the rows of bushes by hand. Hellebore should not be used within 4 to 6 weeks of gathering the fruit. In winter, the surface soil should be renewed to a depth of 2 inches in order to remove the cocoons. *Hyalopterus arundinis* (*pruni*) (mealy

plum aphis) is a widely distributed species injurious to plum and apricot. It migrates from the plum in late summer to reeds and returns to plum in the autumn, when sexual forms are produced. Eggs are laid on the plum which hatch in the following spring and give rise to wingless females, each of which founds a new colony. Spraying should be done in early spring before the leaves have curled and form a protection from the liquid. Paraffin emulsion or paraffin jelly is recommended, with the addition of liver of sulphur in the proportion of 1 lb. to each 100 gals. of spray.

Hylemyia coarctata (wheat bulb fly) continues to be responsible for considerable loss of wheat, the complete life-cycle of this pest being still unknown. It is difficult for this reason to advise remedial measures, but it is thought that cultural methods may prove more helpful than destructive measures against the larvae. It is considered inadvisable to follow a potato crop with wheat in districts where the pest is prevalent. *Chortophila brassicae* (cabbage root fly) is a well-known pest of cabbages, cauliflowers, radish, broccoli and turnip. The use of tarred felt paper discs is still considered the best remedy for this pest. *Hydroecia micacea* (rosy rustic moth) is a Noctuid attacking many wild plants, while cultivated plants, such as hollyhock, hops, tomato fruits and potatoes are also damaged by it.

Furniture beetles include *Anobium domesticum*, which oviposits in chinks in the wood, the larvae tunnelling into the wood and partially emerging again to pupate. *Xestobium tessellatum* is found out-of-doors as well as in furniture. Furniture infested with these species should be fumigated with sulphur dioxide, or the holes may be treated individually with paraffin applied with a syringe having a very fine nozzle. A temperature of 125° F. would kill the insects in all stages. The wood may also be painted with naphthaline 780 grs., corrosive sublimate 80 grs., methylated spirit 1½ pints. *Sitodrepa panicea* is destructive to food-stuffs such as flour, biscuits, coffee, beans, various drugs, and spices; leather, books, manuscripts and pictures are also attacked. Fumigation with carbon bisulphide is recommended. *Monomorium pharaonis* (red or yellow house ant) frequently infests houses in Britain, feeding upon foodstuffs, as well as being carnivorous. Its numbers can be checked by traps, but this is a tedious method. Tables on which food is kept should be placed with the legs set in vessels of water. The only satisfactory measure is the destruction of the nests, but these are frequently inaccessible in buildings.

RIGGS (W. M.). **Report of the South Carolina Boll Weevil Commission.** *S. Carolina Agric. Expt. Sta., Clemson College*, Bull. no. 20, 23rd November 1916, 23 pp.

This report reviews the conditions as regards *Anthonomus grandis* in other States and discusses the inevitable results of the probable introduction of this weevil into South Carolina. Intelligent co-operation amongst the community is urged, in order to make all possible provision for meeting the first year of weevil infestation and to prevent disaster due to the initial panic following the first crop failure. The general aspects of the boll weevil question dealt with include the life-history of the pest, the record of its spread in the United States, climatic and other conditions of South Carolina as

compared with other States, and the cultural methods that are the only known means of control in infested fields. The effects of boll-weevil infestation are discussed, with its bearing upon cotton production, oil mills, ginneries, etc., as well as upon labour and land values, together with the changes in agricultural methods which the presence of the weevil entails. The importance of hastening the growth of plants so as to insure a large crop of bolls by the middle of July is emphasised, and simple directions are given for following scientific methods of cultivation which will represent a good investment while no weevils are present and will check their numbers when they do become introduced. The report closes with general observations, suggestions and recommendations to be followed in preparation for boll weevil conditions.

WEISS (H. B.). **Isaac P. Trimble, M.D., Early Economic Entomologist of New Jersey.**—*Entom. News, Philadelphia, Pa.*, xxix, no. 1, January 1918, pp. 29–32.

In this brief account of the life and works of Dr. I. P. Trimble (born 1804—died 1890) mention is made of his "Treatise on Insect Enemies of Fruits and Fruit Trees" published in 1865, a work of 139 quarto pages dealing with the plum curculio [*Conotrachelus nenuphar*] and codling moth [*Cydia pomonella*]. In 1866 the New Jersey Agricultural Society received a grant of £600 for preparing and publishing this work, none of which went to the author, but which was used by the society in publishing and purchasing copies of the book for distribution. The article concludes with a list of nine entomological papers published by Dr. Trimble between the years 1864 and 1870.

FULLAWAY (D.). **Division of Entomology.**—*Hawaiian Forester & Agriculturist, Honolulu*, xiv, no. 12, December 1917, p. 356.

During the month of November the insectary handled 29,400 pupae of the melon fly [*Dacus cucurbitae*] from which 1378 individuals of *Opius fletcheri* were bred and distributed. The following parasites were also distributed:—*Tetrastichus*, 700; *Diachasma fullawayi*, 110; *D. tryoni*, 665; *Paranagrus* (corn leaf-hopper parasite), 13,500.

PORTER (C. E.). **La Ultima Invasión de Langosta Argentina.** [The Latest Invasion of the Argentine Locust.]—*Anales Zool. Aplicada, Santiago de Chile*, iv, no. 1, 30th May 1917, pp. 19–24, 1 fig. [Received 2nd February 1918.]

This paper contains the official report of a locust invasion that occurred in Chile in January 1917. The species concerned was *Schistocerca paranensis*, Burm. (Argentine locust) which has on previous occasions invaded the south of Chile. Apparently no serious damage was done to agriculture and no complaints of losses have been made. Writing before the end of the invasion the author considers that in view of the season in which the swarm appeared, the unfavourable climatic conditions for acclimatisation of the locust on that side of the Andes, and considering the history of previous invasions, it is unlikely that locusts hatching from the eggs laid will ever develop into hoppers.

Noticias. [Notes.]—*Bol. Soc. Entom. de España, Zaragoza,* I, nos. 1–2, January 1918, pp. 31–32. [Received 8th February 1918.]

From Barcelona the Coccid, *Ceroplastes rusci,* L., is recorded on leaves of fig (*Ficus carica*), while *Saissetia* (*Lecanium*) *oleae,* Bern., infests lemon trees (*Citrus limonum*). Cocoons of the moth, *Eublemma* (*Thalpochares*) *scitula,* Ramb., which is predaceous upon these two species, were found accompanying them.

Attention is drawn to the damage caused in coffee and cacao plantations in India by *Nezara viridula,* L., as this bug occurs also in Spain.

Afanassiev (A. P.). **Русское Виноградорство въ 1915 году (III-й вегетаціонный періодъ).** [Russian Viticulture in 1915 (The third Vegetative Period)].—**«Вѣстникъ Виноделія.»** [*Messenger of Viticulture*], *Odessa,* xxvi, nos. 3–4, 5–6, 9–10; March-April, May-June, September-October 1917; pp. 90–100, 150–159, 302–314. [Received 12th February 1918.]

This is the third instalment of reports dealing with the state of viticulture in Russia in 1915, summarised on the lines of the previous ones [see this *Review,* Ser. A, iii, p. 375 and v, p. 194]; it covers the months of August-September. No insect pests were reported from the majority of vine-growing districts. In Bessarabia some damage was done by *Clysia ambiguella*; in Taurida by *Polyphylla fullo, Otiorrhynchus* and *Pseudococcus vitis,* against which the stocks were smeared with spirit mixed with hempseed oil. In the province of Don *Eriophyes* (*Phytoptus*) was present in several localities in great numbers, the same pest being also reported from the Black Sea. *Polychrosis botrana,* which was controlled with barium chloride, was reported from Astrakhan and Tiflis.

Sanders (G. E.). **Apple Spraying.**—*Canadian Horticulturist, Toronto,* xli, no. 1, January 1918, pp. 1–3.

The greater part of the subject matter of this article has already been noticed from another source [see this *Review,* Ser. A, v, pp. 343 and 345]. Subsequent experimental work during 1917 has shown that the yellowing of apple foliage resulting from the use of calcium arsenate with sodium sulphide may be avoided by reducing the quantity of arsenate and adding an excessive quantity of either water-slaked lime or hydrated lime. One combination, four applications of which gave no trace of yellowing or scorching, is composed of $2\frac{1}{2}$ to $3\frac{1}{2}$ lb. soluble sulphur (a sodium sulphide), $1\frac{1}{4}$ lb. calcium arsenate, 15-20 lb. of either hydrated or water-slaked lime and 100 gals. water.

Potassium sulphide or liver of sulphur is one of the old-fashioned fungicides which acts in the same manner as the sodium sulphides; it is safe alone, but dangerous when used with any of the metallic arsenates. It can be used with perfect safety with calcium arsenate provided that an excess of lime be present. Nicotine sulphate can be used with any of the fungicides or poisons with perfect safety, but is more efficient with sodium sulphide solutions than with lime-sulphur or Bordeaux mixture.

HOLLINGER (A. H.). *Phenacoccus stachyos*, **Ehr.** (= *P. pettiti*, **Hollinger.**)—*Canadian Entomologist, London, Ont.*, l, no. 1, January 1918, pp. 23–24.

The author draws attention to the fact that the mealy bug from Missouri, described by him as new under the name *Phenacoccus pettiti* [see this *Review* Ser. A, v, p. 470] proves to have been previously described.

HARTZELL (F. Z.). **The Grape Root-worm.**—*New York Agric. Expt. Sta., Geneva*, Circ. no. 41, 21st June 1915, 6 pp., 2 plates, 4 figs. [Received 11th February 1918.]

The larva of the Chrysomelid beetle, *Fidia viticida*, Walsh, is one of the most injurious pests in the Chautauqua and Erie Grape Belt, where in some years it has caused a loss of more than £100,000. During July and August, each female lays about 175 minute yellow eggs under the rough bark of the canes and older wood, after which they die, though individuals have been found as late as the first week in September. The larvae, which hatch in August, drop from the vines and burrow into the soil till they reach the roots, on which they begin to feed, attacking first the rootlets and then the larger roots, into which they eat channels, even girdling them. At the end of October they burrow to a depth of from 10-24 inches into the soil and form cells in which they hibernate until May, when they again begin feeding on the roots. Early in June the full-grown larvae form cells 4-10 inches beneath the surface of the soil, the depth being largely influenced by moisture conditions, and enter the pupal stage from 10th to 15th June. The adults, which emerge after 10-14 days, feed by tearing the upper tissues of the leaves.

Remedial measures must be directed against the pupae or adults, all attempts to kill the larvae in the soil, or before entering it, having proved impracticable. The pupae may be destroyed by forming a low ridge underneath the vines during the last cultivation of summer and removing it next spring by means of an implement called a horse-shoe, thus crushing the pupae or breaking the cells, when the pupae are killed by the air and sunlight. This operation, which entails no additional expense, is an effective measure, though some of the deeper pupae will escape destruction.

Spraying with arsenicals to destroy the adults before oviposition has yielded the best results, but this spray acts only as a repellent unless mixed with molasses to attract the beetles. Therefore in practice, if the beetles are numerous, a spray of lead arsenate 6 lb., molasses 1 U.S. gal., and water 100 U.S. gals., should be applied, care being taken not to do this just before rain, a second application of lead arsenate 6 lb. and Bordeaux mixture (88–100) being given a week later. The length of time between sprayings must depend on the temperature, rainfall, the amount of new growth and the feeding of the beetles. The cumulative effect of this treatment is very marked after a few years, serious infestations of root worm rarely occurring in vineyards where it has been followed.

WEBSTER (R. L.). **The Box Elder Aphid** (*Chaitophorus negundinis*, **Thomas.**)—*Iowa State Coll. Agric. Expt. Sta., Ames*, Bull. no. 173, October 1917, pp. 95-119, 12 figs. [Received 11th February 1918.]

Chaitophorus negundinis (box elder aphis) is abundant on box elder (*Negundo aceroides*), but has not been recorded from any other trees except adjacent catalpas. Oviposition occurs in October, the insect hibernating in the egg-stage. The usual life-cycle is varied by the occurrence of a dimorphic form during the summer, consisting of minute, flat, apterous individuals that remain inactive on the leaves from June till September, when they moult and become active forms.

Control measures directed against the egg-stage consist in spraying with tobacco extracts, a solution of Blackleaf 40, 1 part in 500 parts of water, being reliable and effective. The eggs of *C. negundinis* are said to be more easily killed than those of any other species. Spraying is best performed in May or September, but is useless against the dimorphic forms, which lie too flat on the upper and under-surfaces of the leaves to be attacked. Kerosene emulsion, consisting of kerosene 2 U.S. gals., hard soap ½ lb. (or soft soap 1 lb.), and water 1 U.S. gal., diluted for use in the proportion of 1 part stock solution to 9 parts water, has given good results, and spraying with whale-oil soap solution, 1 lb. in 10 U.S. gals. water, is also an effective measure.

In view of the fact that box elder is not a very desirable tree, the simplest way to destroy this Aphid is to cut down the trees that harbour them, replacing them by permanent shade-trees such as elms or maples.

The species is held in check by several natural enemies, the chief being the larvae of the Syrphid flies, *Allograpta obliqua*, Say, and *Syrphus americanus*, Wied.; an Agromyzid larva, *Leucopis* sp. near *L. griseola*, Fall.; a Cecidomyid larva, *Aphidoletes* sp.; the Coccinellids, *Hippodamia convergens*, Guér., *Cycloneda sanguinea*, L., *Adalia bipunctata*, L., and the larvae of *Scymnus americanus*; the bugs, *Triphleps insidiosus*, Say, and *Plagiognathus annulatus*, Uhler; the predaceous mite, *Rhyncholophus pilosus*; the Hymenopterous parasites, *Praon coloradensis*, Ashm., and *Aphidius polygonaphis*, Fitch; and three Chrysopids reared from larvae, *Chrysopa nigricornis*, Burm., *C. plorabunda*, Fitch, and *C. oculata*, Say.

PARROTT (P. J.) & FULTON (B. B.). **The Cabbage Aphis.**—*New York Agric. Expt. Sta., Geneva*, Circ. no. 30, 15th June 1914, 4 pp., 2 plates, 1 fig. [Received 11th February 1918.]

The damage caused by *Aphis brassicae*, L. (cabbage aphis) may be greatly reduced, if not prevented, by timely spraying. The eggs are deposited during October and the beginning of November in depressions of the under-surfaces of the leaves. They hatch in spring, usually during April, giving rise to females that reproduce parthenogenetically. Winged females appear at varying periods, spreading the infestation, and in autumn the sexual forms appear, depositing eggs and completing the life-cycle.

The plants should be sprayed before the leaves are appreciably curled, with a solution of soap, 6-8 lb. in 50 U.S. gals. water or with Black leaf 40, ¾ pint, soap 3-5 lb., water 100 U.S. gals. The liquid

should be applied under pressure especially into the heart and against the under-sides of the leaves, three treatments at intervals of fourteen days giving the most satisfactory results.

Howitt (J. E.) & Caesar (L.). **The More Important Fruit Tree Diseases of Ontario.**—*Ont. Dept. Agric., Toronto,* Bull. no. 257, December 1917, 43 pp., 28 figs.

To this bulletin is appended a spray calendar, giving the number and times of applications against the common diseases and insect pests of apple, pear, plum, cherry and peach trees. There are also formulae for the common insecticides and fungicides.

Sanders (J. G.). **Setting Fruit Trees where Locusts are Expected.**—*Wkly. Press Bull., Pennsylvania Dept. Agric., Harrisburg,* iii, no. 6, 7th February 1918.

A warning is issued against the planting and pruning of young fruit trees in certain districts of the State of Pennsylvania, either in 1918 or 1919, on account of the expected appearance of brood x of the 17-year locust [*Tibicen septemdecim*], which is due in 1919.

Campbell J. A.). **Work for the Coming Month. The Orchard.**—*Jl. Agric. Wellington,* N.Z., xv, no. 6, 20th December 1917, pp. 346–348.

These notes recommend the usual treatments against common orchard pests. Thus red mite [*Tetranychus*] can be held in check by the continual use of lime-sulphur combined with lead arsenate when spraying for codling moth; if woolly aphis [*Eriosoma lanigerum*] is to be dealt with at the same time, Black-leaf 40 should be added, or Black-leaf 1-800, and lead arsenate alone may be used. The second brood of codling moth [*Cydia pomonella*], which, hatches out far more simultaneously than the first, is on the wing during the latter half of January and February; consequently the fruit and foliage must be kept covered with lead arsenate mixture during this dangerous stage. The pear-slug [*Eriocampoides limacina*] is easily controlled by spraying once or twice during the season with lead arsenate.

Dodd (A. P.). **The Cane Grubs of Australia. Part II.**—*Queensland Bureau of Sugar Expt. Stations, Brisbane,* Div. Entom. Bull. no. 6, 1917, 30 pp. [Received 22nd February 1918.]

Further investigation [see this *Review* Ser. A, iii, p. 490] has established the fact that *Lepidiota albohirta, L. rothei, Cacochroa decorticata, Anomala antiqua* (*australasiae*), and probably *Dasygnathus australis, Semanopterus depressiusculus* and *Haplonycha* sp., have a one-year life-cycle, while most other species of cane-grubs take two years to complete their development.

Lepidiota albohirta was not unusually abundant in 1915, and there was no great damage to cane-fields except in isolated cases where estates on open volcanic soils had hundreds of acres of cane completely killed. Pupae ploughed up during September and October were found not deeper than 8 inches, owing to frequent rains in August and September having kept the soil moist. In 1914 there appears to have

been no general emergence, but one took place in 1915 on December 4th, followed by one from the red volcanic cane-fields on December 12th. This species had remained an abnormal period in the ground before pupating on this occasion, owing to the absence of rain, as no emergence can take place until rain has moistened the soil. The length of life is generally limited to one month, the female living longer than the male. Cane leaves are occasionally eaten, but not to any great extent, this being the only species of *Lepidiota* that remains among the foliage in the day-time.

Details of the life-histories of *L. frenchi*, Blackb., *L. rothei*, Blackb. *L. caudata*, Blackb., and of five undetermined species of this genus are given, as well as of *Anoplognathus boisduvali*, Boisd., *Calloodes punctulatus*, Oll., *Cacochroa decorticata*, Macl., *Anomala antiqua*, Gyll. (*australasiae*, Blackb.), *Repsimus aeneus*, F., *Isodon puncticollis*, Macl., *Xylotrupes australicus*, Thoms., *Horonotus optatus*, Sharp, *Dasygnathus australis dejeani*, Macl., *Semanopterus depressiusculus*, Macl., *Epholcis bilobiceps*, Fairm., and of two undetermined species of *Haplonycha* and one of *Heteronyx*.

Many natural enemies of the various cane grubs are known, but as none of them are plentiful, they do not effect any marked control. The external larval parasites are the three Scoliids, *Dielis formosa*, Guér., *Discolia soror*, Smith, and *Campsomeris radula*, F., which in their turn are parasitised by a Mordellid and a Bombyliid. The internal larval parasites are eight unidentified species of Dexiid flies, while the adults are parasitised by two Diptera. Predaceous enemies comprise the larvae of four species of Asilid flies, and the larva of one Elaterid beetle.

A key to the four sub-families of the SCARABAEIDAE, the Cetonides, Melolonthides, Rutelides, and Dynastides, based on the larval characters, is given; also one to the Melolonthides, Rutelides, and Dynastides based on those of the pupae.

MALLOCH (J. R.). **A Preliminary Classification of Diptera, exclusive of *Pupipara*, based upon Larval and Pupal Characters, with Keys to Imagines in Certain Families. Part I.**—*Bull. Illinois State Lab. Nat. Hist., Urbana*, xii, Article 3, March 1917, pp. 161–407, 30 plates. [Received 4th February 1918.]

The character of this work is indicated by its title. In discussing the economic importance of the Diptera, it is pointed out that while many of the families are largely beneficial, the good done by them is counterbalanced by the damage inflicted by other species. Families that are essentially phytophagous are the CECIDOMYIIDAE, TRYPETIDAE, AGROMYZIDAE and CHLOROPIDAE. A few species in these families are predaceous and others are beneficial in keeping down noxious plants. True parasites, some of which are highly beneficial, include members of the TACHINIDAE, DEXIIDAE, and PIPUNCULIDAE.

VAN DYKE (E. C.). **New Species of Buprestidae (Col.) from the Pacific States—No. 2.**—*Entom. News, Philadelphia, Pa.*, xxix, no. 2, February 1918, pp. 53–58.

The species dealt with in this paper include *Melanophila californica*, sp. n., from yellow pine (*Pinus ponderosa*), Jeffrey pine (*P. jeffreyi*),

digger pine (*P. sabiniana*) and big-cone spruce (*Pseudotsuga macrocarpa*), the species being apparently confined to California; *Chrysobothris falli*, sp. n., from yellow pine and Jeffrey pine; *C. laricis*, Van Dyke, probably breeding in the lodge-pole pine; and *C. exesa*, Lec., taken on mesquite (*Prosopis juliflora.*).

GIRAULT (A. A.). **The North American Species of *Cerchysius*, Females (Hym., Chalcid.).**—*Entom. News, Philadelphia, Pa.*, xxix, no. 2, February 1918, pp. 65–66.

In this paper a key to the genus *Cerchysius* is given, and the female of *C. whittieri*, sp.n., a parasite of *Saissetia* (*Lecanium*) *oleae* at San Francisco is described.

PEMBERTON (C. E.) & WILLARD (H. F.). **Fruit-fly Parasitism in Hawaii during 1916.**—*Jl. Agric. Research, Washington, D.C.*, xii, no. 2, 14th January 1918, pp. 103–108.

Much careful data with regard to the parasitism of the fruit-fly [*Ceratitis capitata*] in Hawaii during 1916 has been accumulated in continuation of the work of previous years [see this *Review*, Ser. A,iii, p. 412.]. The exact degree of infestation of large quantities of host fruits by the fruit-fly is tabulated, showing the infestation in various localities and also the amount of parasitism among the larvae from month to month and the seasonal efficacy of each parasite. Seasonal differences in the value and prolificness of certain species of introduced parasites have been most striking; particularly is this shown in the inspection of records from fruit collected from the same localities month by month from trees that bear fruit which is normally a host of the fruit-fly continuously throughout the year. The work of 1916 has demonstrated the fluctuations that may occur in the abundance of different species. *Diachasma tryoni*, Cam., was found to rise in numbers in the summer and autumn and to decline during the winter and spring months. Changes in temperature seem to be responsible for this. *Opius humilis*, Silv., although a more hardy and prolific species than any of the other introduced ones, showed directly the reverse in its seasonal rise and fall, which was apparently entirely dependent upon the rise and fall of *D. tryoni.* Slight changes in temperature do not seem to have any visible effect upon the activities of *O. humilis*, since in the winter and spring, with the decline of *D.tryoni*, it rapidly ascends and becomes the most effective check upon the fruit-fly.

The problem of the control of *C. capitata* in Hawaii by means of parasites is only partly solved. Although the four species already established are accomplishing a certain measure of control, the continued destructiveness of the pest in Hawaii remains only too obvious. An average parasitism of 40 per cent. of all the larvae developing is, numerically considered, of much importance; but from the standpoint of the practical needs of the horticulturist it brings little relief. The first table given in this paper shows the extent of infestation of host-fruits by larvae of *C. capitata* in the course of the year, the exact average condition of fruit-fly abundance, injury and parasitism being recorded. In the mango (*Mangifera indica*), guava

(*Psidium guajava*), *Mimusops elengi*, *Noronhia emarginata* and Chinese orange (*Citrus japonica*), fruit-fly larvae develop abundantly and are but slightly parasitised, as is shown in another table recording the percentage of larval parasitism in various fruits. Certain characters of these fruits prevent the parasites from reaching the larvae within, and this in part explains the constant presence of this pest, in spite of the establishment of parasites well adapted to the conditions of the country and of great prolificness. The guava, which grows wild over most of the uncultivated parts of the island and fruits throughout the year, is a favourite host of the fruit-fly. Infestation of this fruit is not easily detected until it has decayed, while the nature of the fruit protects the larvae from parasitic attack and thus it constantly liberates great numbers of flies throughout the year.

A comparison of fruit-fly parasitism data secured during the years 1914-1916 would indicate that the parasites now present in the Territory have reached their maximum degree of development and can hardly be expected to attain a greater control of the fruit-fly than that evidenced in 1916. It is still hoped, however, that *Tetrastichus giffardianus*, Silv., may afford some measure of control. Certain valuable points in favour of this parasite may enable it, after further acclimatisation and adaptation to new environment, to surpass the work of the Braconids and thus increase the total average parasitism.

HECKE (G. H.). **Response and Report to the Fiftieth State Fruit Growers' Convention. The Insectary Division.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, vii, no. 1 & 2, January-February 1918, pp. 6–7.

The greater part of the work of the laboratory during the year consisted of the rearing and distribution of the natural enemies of the citrophilus mealy bug [*Pseudococcus citrophilus*], especially of the Sicilian mealy bug parasite [*Paraleptomastix abnormis*].

Attempts were made to parasitise the sugar-beet leaf-hopper [*Eutettix tenella*] by the introduction of an egg-parasite from Australia, where it attacks 90 per cent. of the eggs of allied leaf-hoppers. The work is to be continued next year. Much attention was given to the control of the Argentine ant [*Iridomyrmex humilis*] in orchards, this insect being indirectly an orchard pest owing to its habit of protecting scale-insects from their natural enemies.

About 80 millions of Coccinellids were sent out to farmers during the season for the control of Aphids.

Serious attempts are being made to control insect pests by means of natural enemies, rather than by spraying, a method which cost the farmers of California £800,000 during 1917.

GILL (J. B.). **The Pecan Leaf Case-Bearer.**—*U. S. Dept. Agric., Washington, D.C.*, Bull. no. 571, 15th December 1917, 28 pp., 3 plates. [Received 25th February 1918.]

Acrobasis nebulella, Riley (pecan leaf case-bearer) is one of the principal insect pests of the pecan nut (*Carya olivaeformis*). The synonomy of this moth is discussed. It has been erroneously treated by some authors as a variety of *Mineola indiginella*, Z. It is widely

distributed in the United States, but ranks as a serious pest only in the southern part of the pecan-growing area. It is found practically wherever the various hickories that are its preferred food occur. Wild crab (*Crataegus* sp.) and walnut are also attacked, while the pecan industry is seriously affected by its ravages.

The eggs of *A. nebulella* are deposited singly on the under-side of the leaflet, usually at the junction of the veins with the midrib, during the latter part of July, and after an incubation period of 6 to 8 days the larvae hatch and begin to feed on the under leaf-surface. Feeding continues for about 3 months, during which time the larvae are protected by a case composed of particles of frass or grains of excrement woven together with fine silken threads; this is attached to the under-surface of the leaflet, with the larger end open. In late September, before the foliage begins to drop, the larvae migrate to the buds, where they construct small brown cases in which they hibernate, remaining quiescent until late March or early April, and just as the buds are bursting they leave their winter cases and feed voraciously upon the unfolding buds and leaves. When present in sufficient numbers, the larvae are able to eat the green foliage as rapidly as it appears, so that the trees may remain defoliated for a considerable time. The pupa is formed within the case during the last days of April, the adults beginning to emerge in the middle of May and continuing to do so until mid-July.

Natural enemies that act as a check on this case-bearer, without however constituting an efficient control, include three species of birds, the blue jay (*Cyanocitta cristata*), the mocking-bird (*Mimus polyglottus*) and the orchard oriole (*Icterus spurius*). Hymenopterous parasites reared by the author from larvae and pupae of *A. nebulella* include the Ichneumonids, *Itoplectis conquisitor*, Say, *Triclistus apicalis*, Cress., *Calliephialtes grapholithae*, Cress., and *Pristomerus* sp.; the Braconids, *Macrocentrus delicatus*, Cress., *Meteorus* sp. *Habrobracon variabilis*, Cush., and *Orgilus* sp.; and the Chalcidids, *Secodella acrobasis*, Cwfd., and *Cerambycobius* sp. Tachinid parasites include *Leskiomima tenera*, Wied., and *Exorista* sp. near *E. pyste*, Walk., thi being probably a new species. Other parasites include *Spilochalcis vittata*, F., and *Trichogramma minutum*, Riley, reared from the eggs. The most effective parasite is *Secodella acrobasis*, which was reared abundantly from hibernating larvae.

The results of experimental work in the control of *A. nebulella* extending over a period of more than three years are given in detail, and these show conclusively that even bad infestations can be controlled by a single application of a solution of 1 lb. powdered or 2 lb. paste lead arsenate and 3 lb. freshly slaked lime in 50 U.S. gals. water. If the lime be omitted, injury to the tree will result. This spray must be applied after the beginning of August and up to mid-September, while all the larvae are feeding on the foliage. Hibernating larvae that have escaped the spray can be destroyed by fumigation for one hour with $1\frac{1}{2}$ oz. sodium cyanide to each 100 cub.-ft. of space.

La Lutte contre la Chenille processionnaire du Pin. [The Campaign against the Pine Processionary Caterpillar.]—*Jl. d'Agric. Pratique, Paris*, xxxi, no. 4, 21st February 1918, pp. 77–78.

For the control of the pine processionary caterpillar [*Cnethocampa*

processionea], it is necessary to treat the terminal branches and young twigs that frequently harbour the nests of the larvae. A hole is made in the top of the nest into which is poured a few drops of petrol. For nests that are out of reach a special instrument, such as the Pillot apparatus, is required. The best treatment for nests on the lateral branches is to cut off the ends of these and burn them immediately. The operator should wear gloves when handling the nests.

McColloch (J. W.) & Yuasa (H.). **Notes on the Migration of the Hessian Fly Larvae.**—Reprint from *Jl. of Animal Behaviour*, vii, no. 5, September-October 1917, pp. 307–323. [Received 22nd February 1918.]

In the course of investigations into the migration of young larvae of the Hessian fly (*Mayetiola destructor*, Say) from the spot where the egg is deposited to the base of the leaf-sheath, it was found that the larvae upon hatching always turn from the anterior end towards the posterior end of the eggs. The advantage of this is obvious, for the eggs are normally laid with their anterior end pointing away from the base of the leaf, and since the larvae emerge from that end of the egg, they must turn round before they can reach the leaf-sheath upon which they feed. The larvae are capable of locomotion on either an ascending or descending incline at any angle up to 90°. When the eggs are laid with their anterior ends towards the base of the leaf, as is sometimes the case, the larvae upon hatching crawl up the leaf until they reach the tip and then turn and move downwards. Many of them die while ascending the leaf, but apparently never try to change the direction of progress. The mortality during migration of the larvae hatching from eggs laid normally was 23 per cent., while among those hatching from eggs laid in an inverted position it was 57 per cent. Tables are given comparing the rates of migration of the larvae under various conditions.

Theobald (F. V.). **Notes on New and Little Known British Aphides. IV.**—*Entomologist, London*, li, no. 657, February 1918, pp. 25–29.

The Aphids dealt with in this paper include *Truncaphis newsteadi*, sp.n., found on *Hypnum* spp., being the only species so far recorded as feeding on moss; *Sipha paradoxa*, sp. n., on *Poa trivialis*, the other European members of the genus being *S. maydis*, Pass., on *Holcus* sp. and other Graminaceae; *S. glyceriae*, Kalt., on *Glyceria fluitans* and other grasses and sedges; *S. schoutedeni*, Del Guer., on *Holcus* and *Poa*; *S. berlesei*, Del Guer., on *Aira caryophyllea*; *S. elegans*, Del Guer. on *Hordeum murinum*; *S. graminis*, Kalt., on *Anthoxanthum odoratum*; and *S. bignoniae*, Macch., on *Bignonia catalpa*. *Callipterus ononidis*, Kalt., of which *C. trifolii*, Mon., and *Chaitophorus maculatus*, Buckt., are synonyms, was found in Britain in 1917 for the first time, feeding upon clover. *Cryptosiphum artemisiae*, Pass., of which *Aphis gallarum*, Kalt., is a synonym, was found on *Artemisia vulgare*, and *Tychea phaseoli*, Pass., a subterranean species, on potatoes, turnips and roots of bean plants. This Aphid is accompanied by the ant, *Myrmica ruginodis*. In the case of potatoes, if it attacks the tubers soon after they have sprouted, it appears to stunt the growth.

DAUMÉZON (G.). **Disease of Bacterial Origin observed in** *Sparganothis pilleriana* **in France.**—*Mthly. Bull. Agric. Intell. & Plant Dis., Rome,* viii, no. 12, December 1917, p. 1298. [Abstract from *Bull. Soc. Path. Végétale France, Paris,* iv, no. 1, pp. 8–10.]

Larvae of *Sparganothis pilleriana*, taken from a vineyard at Aramon (Aude), were found to be infected with numerous bacteria resembling the micro-organisms causing "flacherie" in the silkworm. These infected larvae had reached the last moulting stage and the integument was brownish and soft, while the movements of the larvae were feeble. They died in the laboratory before the pupal stage was reached.

LECAILLON (—). **Observations on** *Meigenia floralis*, **a Dipterous Parasite of the Lucerne "Negril"** (*Colaspidema atrum*) **in France.**—*Mthly. Bull. Agric. Intell. & Plant. Dis., Rome,* viii, no. 12, December 1917, pp. 1299–1300. [Abstract from *Comptes Rend. Acad. Agric. France, Paris,* iii, no. 30, pp. 881–885.]

Meigenia floralis was found during observations in 1914 to be living as an internal parasite of the larvae of the Chrysomelid beetle, *Colaspidema atrum*, and to cause its death. In studying the effectiveness of this parasite, *M. floralis* was found to begin to oviposit in the first days of June, and to be capable of continuing to do so after the time at which the last larvae of *C. atrum* have left the lucerne, this being usually about 10th to 15th July. A second generation of *M. floralis* appears before the end of June and can attack the larvae of *C. atrum*, which are then abundant. At their first appearance (10th to 15th May) the larvae of *C. atrum* are very little parasitised, but by the time they begin to be rare they are heavily parasitised, usually containing more than one *M. floralis* egg and sometimes as many as 12, although they do not provide food for more than one parasite. In comparing the parasitism of *Colaspidema atrum* and of *Crioceris asparagi* (asparagus beetle) by *M. floralis*, the author found complete uniformity in both cases. In the case of *C. asparagi*, however, there is a third generation of *M. floralis* that attacks the larvae of *C. asparagi*, these remaining much longer on asparagus than *C. atrum* does on lucerne. The presence of *C. asparagi* is in fact essential to the maintenance of the parasite in a given region, since without this host its third generation could not develop and it would become exterminated.

C. atrum is not held in sufficient check by this parasite and it might be advisable to increase the destructive capacity of *M. floralis*. This could be done by conveying parasitised larvae of *C. atrum*, which are easily distinguishable and carry the parasitic egg on their bodies for some days, from a locality where it occurs abundantly to others where it is uncommon. It would also be advantageous to grow asparagus in those districts where *C. atrum* is harmful, for this plant, being the host-plant of *Crioceris asparagi*, would afford shelter to the last generation of *M. floralis* and allow the parasite to pass the winter until the next season.

FEYTAUD (J.). **Les Curculionides de la Vigne.** [The Weevils of the Vine.]—*Rev. Viticulture, Paris,* xlviii, no. 1227, 3rd January 1918, pp. 5–10, 1 plate.

Much of the information contained in this paper has been previously given [see this *Review*, Ser. A, v, p. 339.]. The natural enemies of the Curculionid pests of the vine are enumerated. In addition to insectivorous birds, the enemies of *Byctiscus betulae* (*Rynchites betuleti*) include the predaceous wasp *Cerceris ferreri*, Lind., and the Hymenopterous parasites *Pimpla flavipes*, Ratz., *Bracon discoideus*, Wsm., *Diospilus capito*, Nees, *Apanteles hoplites*, Ratz., and the Chalcids *Elachistus idomene*, Walk., and *Poropoea defilippii*, Rond. The last-named develops in the eggs, just as *Oophthora semblidis*, Auriv., infests those of *Polychrosis botrana* and *Clysia ambiguella*. Insect enemies of *Otiorrhynchus sulcatus* include various Carabids (*Carabus*, *Feronia*, etc.) and *Cerceris arenaria*, L.

Minor pests belonging to the genus *Otiorrhynchus* that attack vines in France include: *O. singularis*, L., *O. ligustici*, L., *O. tenebricosus*, Hbst., *O. raucus*, F. In Germany, *O. tristis* does similar damage; in Austria-Hungary, *O. planatus*, Hbst., and *O. longipennis*, Stierl.; in Italy, *O. globus*, Boh., *O. corruptor*, Hbst., and *O. zebra*, F.; in Greece, *O. graecus*, Stierl.; in southern Russia, *O. asphaltinus*, Germ., and *O. turca*, Boh. These species all cause damage very similar to that of *O. sulcatus* and should be controlled by the same methods. Leaf-eating species belonging to the allied genus *Peritelus* include *Peritelus senex*, Boh., *P. griseus*, Oliv., and *P. subdepressus*, Muls.

RAVAZ (L.). **Cochenille et Fumagine.** [Scale Insects and Sooty Fungus.]—*Progrès Agric. Vitic., Montpellier,* lxix, no. 6, 10th February 1918, pp. 125–127.

Scale-insects on vines have recently been developing rapidly in the south-west of France. Both *Eulecanium persicae* and *Pulvinaria vitis* are included in records of recent infestation, though neither species constitutes a serious danger to the vine. *P. vitis* is found chiefly on vines trained over the walls of houses or those grown in unhealthy positions, and sometimes on old vines with very rough bark. Most of the insects are destroyed when the vine is pruned, and there are but a few individuals left on the old wood to continue the next generation. It is easy to crush the few ovipositing females that have remained until the next spring. If necessary the bark should be scraped in winter.

SARRA (R.). **La Variegana (*Olethreutes variegana*, Hb., Lepidoptero Tortricide) ed i suoi Parassiti.** [*O. variegana* and its Parasites.]—Separate, dated 12th January 1918, from *Boll. Lab. Zool. Gen. Agrar. R. Scuola Sup. Agric., Portici,* xii, pp. 175–187.

A brief description is given of all stages of *Argyroploce* (*Olethreutes*) *variegana*. This Tortricid pest of fruit trees occurs in central and southern Europe, as well as in Livonia, Finland, Sweden and Asia Minor. In Italy adults were observed to emerge in May, and oviposition took place in captivity from about mid-May to mid-June, 170 eggs being laid on an average. It is probable that under natural conditions

batches of eggs are laid in cracks in the bark or wood. The caterpillars hatch in the following March, and pupation occurs in April and May. The larval stage lasts about 40 days and the pupal stage from 14 to 25 days. The pupae are usually found protected by leaves, under the bark and in cracks in the trunks. Very occasionally they occur in the young fruit of the almond. There is one generation a year only. In south Italy the caterpillars live on *Mespilus germanica* (medlar), *Prunus domestica* (plum), *P. amygdalus* (almond), *P. armeniaca* (apricot) *P. mahaleb* and *Pyrus malus* (apple). Other authors have also recorded it from *Prunus avium* (bird cherry), *P. cerasus* (cherry), *P. insititia* (damson) and *Pyrus communis* (pear). Besides feeding on the leaves the caterpillars construct a shelter by binding them so as to form a case. On the almond and plum 3 or 4 leaves are used for this purpose and from 4 to 6 on the medlar, where the case always encloses the flower-bud or the young fruit, which are perforated or entirely destroyed. The leaves only of the plum, apricot, apple and *Prunus mahaleb* are injured. On the almond the leaves are usually attacked, the young fruit being very rarely injured.

A. variegana has five natural enemies: an Encyrtid, *Copidosoma* sp., the Braconids, *Ascogaster quadridentatus*, Wesm., *Apanteles longicaudis*, Wesm., and *Macrocentrus thoracicus*, Nees, and the Ichneumonid, *Pristomerus vulnerator*, Curtis. By collecting the caterpillars of *A. variegana* and placing them in boxes covered with a wire netting of 2-millimetre mesh the adult parasites will be able to escape while the moths will be retained. *Ascogaster quadridentatus* and *Pristomerus vulnerator* both parasitise *Cydia* (*Carpocapsa*) *pomonella* as well. If artificial control becomes necessary, a spray containing 1 per cent. of lead arsenate in paste form, or ½ per cent. in powder form, should be employed.

Destruição dos Cupins. [Termite Destruction.]—*Chacaras e Quintaes, S. Paulo*, xvi, no. 6, 15th December 1917, pp. 477–479, 2 figs.

The termites mentioned in this article as occurring in Brazil include *Eutermes ripperti*, Ramb., *Termes tenuis*, Hag., *T. strunki*, Sören., and *T. spinosus*, Latr.

A simple means of destroying a termite mound consists in hollowing out a chamber in one side of its base, in which straw or other material is placed and set alight, a draught being ensured by a hole driven obliquely through the mound, leading from the top of the combustion chamber to a point high up on the opposite side.

Paravicini (E.). **Zur Biologie der Maulwurfsgrille.** [The Biology of the Mole-Cricket.]—*Schweiz. Zeitschr. Obst- u. Weinbau, Frauenfeld*, xxvii, no. 3, 9th February 1918, pp. 40–42.

This paper records experiments in feeding *Gryllotalpa gryllotalpa* (*vulgaris*) with sawdust. The larvae did not feed on this material, but the adults were capable of digesting it, thus proving their ability to attack woody tissue. *G. gryllotalpa* is therefore able to injure the roots of fruit-trees and cannot be regarded as a market-garden pest only.

MAKI (M.). **Taiwansan soju gaichu ni kan suru chosa hokoku.** [Report on Injurious Insects of the Mulberry Tree in Formosa.] —*Formosan Government Agricultural Experiment Station*, Publication no. 90, May 1916, 265 pp., 24 figs., plates i–xiv. [Received 1st April 1918.]

This report describes 87 insects and 6 other animals that are known to be injurious to the mulberry tree in Formosa. Some natural enemies and general remedial measures are also described. A description is given of each species, together with its distribution, and when the life-history, habits and preventive measures are known, these are described in detail. The following is a list of all the species dealt with.

Orthoptera. *Brachytrypes achatinus*, Stål, usually appears in abundance after the rains, and the natives utilise the early stages for food. *Atractomorpha bedeli*, Bol., does not cause very serious damage.

Isoptera. *Odontotermes formosanus*, Shiraki.

Thysanoptera. *Phloeothrips* sp. and *Rhaphidothrips* sp., very injurious to the foliage in October and November, and again in April; not so injurious in other months.

Homoptera. *Icerya purchasi*, Mask. *Pseudococcus* sp. *P. citri*, Risso, very injurious and causes the tree to wither. *P. filamentosus*, Ckll., rarer than the preceding species. *P. longicornis*, Ket., rare. *P. virgatus*, Ckll., not very injurious. *Ceroplastes ceriferus*, And., not very injurious. *Saissetia* (*Lecanium*) *nigra*, Niet. *Aulacaspis* (*Diaspis*) *pentagona*, Targ., a formidable pest; found more abundantly in the northern parts of the island than the southern, and more on the plains than in the mountains; there are five broods; gas fumigation and kerosene emulsion are the remedies recommended against it. *Inglisia bivalvata*, Green, very slightly injurious. *Pulvinaria* sp.. *Aleurodes* sp., very injurious; distributed universally from altitudes of 3,000–4,000 feet to the sea-coast; a special fungus infests this insect; soap solution is suggested as an effective spray. *Aleurodes* sp., not such a serious pest as the other species. *Psylla* sp., a notoriously injurious insect, occurring throughout the island. *Nephotettix apicalis*, Mots., rather rare on mulberry trees, although very injurious on Gramineae. *Tettigoniella viridis*, L.; *T. ferruginea apicalis*, Walk.; *Chlorita flavescens*, F.; *Nirvana orientalis*, Mats., var. *rubrosuturalis*, Mats.; *Aphrophora auropilosa*, Mats.; *Dictyophora sinica*, Walk.; *Ossa dimidiata*, Mats.; *Geisha distinctissima*, Walk.; *Tonga formosana*, Mats.; *Mogannia hebes*, Walk.; *Cicada ochracea*, Walk.; all of minor importance.

Heteroptera. *Argenis* sp.; *Nezara viridula*, L.; *Plautia fimbriata*, F. (*stali*, Scott); *Menida histrio*, F.; *Canthecona furcellata*, Wolff, var. *formosana*, Shiraki; *Dalpada smaragdina*, Walk.; *Poecilocoris druraei*, L.; *Erthesina fullo*, Thunb.; *Eusarcocoris guttiger*, Thunb.; *Coptosoma formosana*, Shiraki; *Cletus bipunctatus*, H. S.; *Clavigralla spinofemoralis*, Shiraki; *Acanthocoris sordidus*, Thunb.; *Leptocorisa varicornis*, F.; *Riptortus linearis*, F.; all of minor importance.

Lepidoptera. *Pachyrhina makiella*, Mats., and *Archips minor*, Shiraki, only slightly injurious. *Glyphodes pyloalis*, Walk., very injurious to mulberry leaves, the life-history and habits being described in detail; the insect is single-brooded, the moth appearing in spring;

imported trees are more seriously damaged than indigenous ones, and it is said that the silkworms fed with injured leaves are liable to disease; as a control measure, the larvae should be gathered and killed in November and December. *Diacrisia obliqua*, Walk.; *D. subcarnea*, Walk.; *D. mori*, Mats.; *Amsacta lactinea*, Cram.; *Creatonotus transiens*, Walk.; the larvae of these five species feed on the leaves, but are not very injurious. *Clania variegata*, Cram., appears twice a year; very injurious to *Acacia*, but not so much to mulberry trees. *Orthocraspeda trima*, Moore, not very injurious. *Prodenia litura*, F., a very serious pest, which appears suddenly in great numbers; sometimes the mulberry gardens are completely defoliated, though this is exceptional; it has eight or nine generations a year, and passes the winter in the larval stage; the barrier method is adopted to prevent its spreading. *Boarmia atrilineata*, Butl., has four or five broods in a year, being rather abundant in the northern parts and in the mountainous zone, but is not very injurious. *Boarmia irrorata*, Brem. & Grey, a minor pest. *Orgyia postica*, Walk., has six broods in a year and passes the winter in the larval state; very injurious to mulberry leaves. *O. viridescens*, Walk., has probably six broods in a year; not very injurious. *Dasychira mendosa*, Hb. *Porthesia taiwania*, Shiraki, distributed over the entire island and rather injurious. *Bombyx mandarina*, Moore, of minor importance.

Coleoptera. *Phyllotreta sinuata*, Redt.; *Aspidomorpha koshunensis*, Mats.; *Coptocycla trivittata*, F.; *Aulacophora similis*, Oliv.; *Chrysochus chinensis*, Baly; *Melanauster chinensis*, F.; all these are minor pests. *Hammoderus suzukii*, Mats., very injurious at altitudes above 2,000 feet. *Apriona rugicollis*, Chev., very injurious to mulberry trees, and therefore the life-history is described in detail; under control measures apparatuses for killing larvae and crushing eggs are illustrated and described; the larvae of this and the two preceding Cerambycids may be distinguished from each other by the structure of the dorsal and ventral surfaces of the prothorax. *Baris deplanata*, Roel. *Lixus vetula*, F. *Hypomeces squamosus*, F., usually found on mulberry leaves. *Epicauta gorhami*, Moore, var. *formosanus*, Shiraki. *Lagria rubiginea*, Roel., injurious to the leaves. *Cardiophorus devastans*, Mats. *C. formosanus*, Mats. *Cardiophorus* sp. *Euchlora expansa*, Bates. *E. trachypyga*, Bates. *Cetonia exasperata*, F., injurious to the leaves. *Adoretus sinicus*, Burm. *Xyleborus morivorella*, Niishima, injurious and often causing withering of the tree.

An unidentified Hymenopteron produces galls on the foliage, and a mite, *Tetranychus* sp. causes shrivelling of the leaf.

The following natural enemies are recorded:—*Tetrastichus* sp. parasitic on *Apriona rugicollis*. An unidentified Hymenopteron and a Coccinellid attacking *Aulacaspis pentagona*. The fungus, *Myriangium duriaei*, infesting *Aspidiotus perniciosus*, *Aulacaspis pentagona*, *Lepidosaphes beckii*, Newm. (*citricola*, Pack.) and *Chionaspis* sp. *Nectria coccophila*, another fungus infesting scale-insects. A Proctotrupid parasitic on *Pseudococcus filamentosus*. Two species of Coccinellids and some fungi infesting Aleurodids. *Ptychanatis axylidis*, Pall., *Coccinella septempunctata*, F., and *Chrysopa* sp. predaceous on *Psylla*. Three species of Braconids and *Aspergillus* sp. parasitic on *Glyphodes pyloalis*, Walk.

A list of native names of insects is appended.

KUWANA (I.). **Taisho rokunen no gaichukai.** [Observations on Injurious Insects and their Control in 1917.]—*Byochugai Zasshi* [*Journal of Plant Protection, Japan*], v, no. 1, January 1916, pp. 1–5.

This paper describes the principal injurious insects that made their appearance in 1917. The gipsy moth [*Lymantria dispar*] appeared in July in the Shimane prefecture and at first attacked black alder, *Quercus glandulifera* and *Cryptomeria*, and finally orchards and rice-fields. The immense numbers of caterpillars were also very troublesome in houses, etc. This pest also occurred in the Toyama prefecture at the same time. Outbreaks on this scale have not been previously recorded. The caterpillars of *Euproctis flava* and other species with urticating hairs occurred in the Niigate prefecture in such numbers as to be troublesome to troops in that locality. At Nikko an undetermined caterpillar defoliated the beech trees. *Schoenobius incertellus* (the three-brooded rice-borer) occurred in considerable numbers. The first brood of *Chilo simplex* (two-brooded rice-borer) was less numerous than usual, with the result that farmers neglected their control measures; the second brood, in consequence, was exceptionally abundant. Rice leaf-hoppers occurred at Kiushire and Shitoku Island and did some damage in the autumn. A bud-fly, a species of *Diplosis*, infesting mulberries appeared in several places and did considerable injury to sericulture. As regards control and preventive measures in 1917, several publications were issued regarding mosquitos, lice and flies. Electric lights were utilised to capture injurious insects as the result of an agreement between the electric light companies and farmers in the Fukuoka and Yamaguchi prefectures. An investigation of insects injurious to stored grain was organised at the Imperial Plant Quarantine Station. The Tokyo Entomological Society was established in April.

LEGISLATION.

HECKE (G. H.). **Cotton Boll Weevil. Amendment no. 2 to Quarantine Order no. 26.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, vii, no. 1 & 2, January-February 1918, p. 110.

As the cotton boll weevil (*Anthonomus grandis*, Boh.) is not known to exist in the State of Arizona and the State has therefore declared and is maintaining a quarantine against the entrance of this pest, it is declared that until further orders cotton seed grown in the county of Yuma, Arizona, may be imported into California, subject to the following regulations: Persons contemplating the importing or bringing into the State of California cotton seed grown in the county of Yuma, Arizona, shall first make application for a permit to do so, stating the name and address of the exporter, the locality where the seed was grown, the amount of the importation and the name and address of the importer in California, and must also obtain a certificate in triplicate signed by the Entomologist of the State of Arizona, stating the locality where the cotton seed was grown.

All quarantine orders or regulations promulgated for the protection of the cotton industry in the State of California are also directed against *A. grandis*, var. *thurberiae* and *Pectinophora gossypiella* (pink bollworm).

PAILLOT (A.). **Deux Microsporidies nouvelles, Parasites des Chenilles de** *Pieris brassicae*. [Two new Microsporidian Parasites of the Larvae of *Pieris brassicae*.]—*C.R. Soc. Biol., Paris*, lxxxi, no. 2, 26th January 1918, pp. 66–68, 1 fig.

During the occurrence of a severe infestation of *Pieris brassicae* in the neighbourhood of Lyons in 1917, the author has had ample opportunity of studying the parasitisation of these larvae, and has discovered two new parasitic microsporidia, one of which, *Perezia mesnili*, sp. n., forms the subject of the present note. The other will be described in a later paper.

LIZER (C.). **Un Coccido nuevo para la Republica Argentina:** *Saissetia hemisphaerica*, **Targ.** [A Coccid new to the Argentine Republic: *Saissetia hemisphaerica*, Targ.]—*Physis, Buenos Aires*, ii, no. 12, 30th December 1916, pp. 422–423.

Saissetia hemisphaerica, Targ., has now extended its distribution into the neighbourhood of Buenos Aires, where it has been found on ferns.

BARBARÁ (B.). **Estado actual de los Estudios sobre el** *Coccobacillus acridiorum*, **d'Hérelle.** [The Present Situation of Investigations regarding *Cocccobacillus acridiorum*, d'Hérelle.].—*Rev. Instit. Bacteriologico, Buenos Aires*, i, no. 1, November 1917, pp. 107–113. [Received 26th February 1918.]

This paper reviews the experimental work that has been undertaken with the object of determining the possible value of d'Hérelle's *Coccobacillus acridiorum* in the destruction of locust swarms. From the results arrived at, the conclusions are drawn: (1) That the *Coccobacillus* considered by d'Hérelle as the cause of the epizootic in Yucatan in 1909 is innocuous to the locust after passing a certain length of time in culture media. (2) The organism can however be rendered more virulent by its passage through locusts, until it is capable of killing these by injection in 4 or 6 hours. (3) This virulence is rapidly lost when the organism is exposed to an exterior medium. (4) This virulence, according to the Argentine Commission, is not sufficient to destroy locusts even when the culture is ingested by them in enormous quantities; even at its best the *Coccobacillus* destroyed only 40 per cent. in these circumstances.

Natural epizootics are known to occur among locusts and to cause a definite degree of mortality, which is very difficult to estimate when the disease has been artificially increased. In locusts that have contracted this natural infection, and even in those that show no sign of disease, organisms identical in morphology and bionomics with *C. acridiorum* have been observed, and these can be brought to an equal degree of virulence in the same manner.

There are still many points remaining to be elucidated. It is still disputed whether the *Coccobacillus* isolated from dead locusts is the principal cause of the spontaneous epizootics observed by d'Hérelle in Yucatan and by other investigators elsewhere. These epizootics show greater severity of infection and rapidity of dissemination than can be produced artificially. The possibility of killing in the laboratory

an appreciable percentage of the South American locust, *Schistocerca paranensis*, by means of ingestion of virulent cultures of *Coccobacillus acridiorum*, still remains doubtful. Judging from the negative results obtained by the Argentine Commission in their repeated attempts, it seems probable that in practice, where the chances against success are much greater than in the laboratory, the microbe would prove quite valueless. The question of the economy of this method is also doubtful. The conclusions reached by Velu in his work in Morocco are also quoted [see this *Review*, Ser. A, v, pp. 99, 483].

PHILBROOK (E. E.). **Report of the Special Field Agent in Charge of Gypsy Moth Work.**—*13th Ann. Rept. Maine Commissioner Agric., 1914; Waterville*, 1915, pp. 116–124, 5 plates. [Received 5th April 1918.]

During 1914 the work of the parasite laboratory in the control of the gipsy moth [*Lymantria dispar*], resulted in the breeding and liberation of large numbers of *Compsilura concinnata* and *Calosoma sycophanta*, and of two small colonies of *Schedius kuvanae*, the egg-parasite of the gipsy moth. Large numbers of *Apanteles lacteicolor* and *Meteorus versicolor*, parasites of the brown-tail moth [*Nygmia phaeorrhoea*, Don.], were also successfully bred [see this *Review*, Ser. A, ii, p. 135].

Field work in the most heavily infested districts was carried out during the year by every known method, such as destroying the egg-clusters with creosote, spraying in early spring and again in August with lead arsenate, and taking and destroying the caterpillars by means of burlap in June, July and August. During these months millions of caterpillars were also killed by the bacterial wilt disease known as flacherie.

SUMMERS (J. N.). **Work with Parasites of the Gypsy and Brown-tail Moths in Maine.**—*14th Ann. Rept. Maine Commissioner Agric., 1915; Waterville*, 1916, pp. 116–127, 4 plates. [Received 5th April 1918.]

Details are given of the rearing in the laboratory and the distribution of the parasites of the gipsy moth [*Lymantria dispar*] and of the brown-tail moth [*Nygmia phaeorrhoea*], and some account is given of the history and habits of these parasites. They include *Anastatus bifasciatus*, *Apanteles lacteicolor*, *Meteorus versicolor*, *Compsilura concinnata*, the predaceous beetle, *Calosoma sycophanta*, and *Monodontomerus aereus*, which is a widely-known Chalcid parasite of these two moths, though its value is somewhat questionable.

CADEY (E. J.). **Report of Special Field Agent in Charge of Gypsy Moth Work.**—*14th & 15th Repts. Maine Commissioner Agric., 1915 & 1916; Waterville*, 1916 & 1917, pp. 109–115 & pp. 80–83, 1 plate. [Received 5th April 1918.]

During the years under review work was energetically pursued in control of the gipsy moth [*Lymantria dispar*] and the brown-tail moth [*Nygmia phaeorrhoea*, Don.], which are described as the most feared and most formidable pests in the world. Details are given of the

numbers of gipsy moths destroyed in their various stages. Thousands of parasites have been liberated and distributed, including *Apanteles lacteicolor*, *Compsilura concinnata* and *Meteorus versicolor*, as well as *Anastatus bifasciatus*, a minute parasite that feeds on the egg of the gipsy moth, the results being so satisfactory that in some districts the brown-tail moth has entirely disappeared.

BERNARD (C.). ***Helopeltis*-bestrijding op eene Onderneming in de Djampang.** [*Helopeltis* Control on an Estate in Djampang.]—*Meded. Proefstation voor Thee, Buitenzorg*, lvi, 1917, pp. 4–6.

On a tea estate where about 204,000 lb. of tea was plucked in 1914, the yield rose to about 374,000 lb. in 1915 and a crop of 440,000 lb. was expected in 1916. Instead of this, only about 189,000 lb. was obtained owing to an outbreak of *Helopeltis*, which began after the drought of 1914, became disquieting in June 1915, and reached its maximum in April 1916.

In 1917 more methodical remedial measures were carried out. The tea pluckers collected *Helopeltis* in the morning up to about 8.30 a.m. in the plots where they worked and again in the evening in any place they chose. From June onwards about 100 coolies were employed in collecting the bugs in the plots already dealt with by the pluckers, after an 8-day interval. These coolies worked from early morning to about 11.30 a.m. An additional measure was spraying with a 2 per cent. soap solution after pruning; after 7 or 8 days the plots were again treated and this was done over a period of about 5 months. Gardens in which little wood was formed after pruning and which contained heavily attacked plots were not pruned at first, but after the bushes had recovered somewhat, they were subjected to a light horizontal pruning and subsequently carefully plucked. After the heavy infestation of 1916, which was followed by a severe attack of red rust, ordinary pruning was discontinued and light under-pruning was effected to remove badly developed twigs unsuitable for plucking. This facilitated collection and also rendered the conditions less favourable to the larvae. After the application of these measures an improvement was noticed. Though enormous numbers of *Helopeltis* are still captured, the injury has decreased, and the measures adopted are undoubtedly the chief factor in this improvement. This is confirmed by the fact that whereas at first the larvae formed 50 per cent. of the catches this proportion has now fallen to 10 per cent.

ZEEHANDELAAR (A.). **Moeten we *Helopeltis* bestrijden, is dit loonend?** [Ought we to combat *Helopeltis*—Does this pay?]—*Meded. Proefstation voor Thee, Buitenzorg*, lvi, 1917, pp. 7–15.

This paper records the author's experience as manager of a tea estate where local conditions do not favour control. The climate is very damp, the rains set in early, the ground is broken with deep depressions, the plants are still young (the oldest being 6 years old) and therefore weak, and furthermore the East Monsoon [dry season] is particularly damp.

In 1914–1915 the entire estate was severely attacked. The first remedial measure applied (in 1915) was the rapid pruning of a large area, but the collection of *Helopeltis* was the chief measure relied on.

The estate was divided into lightly, heavily and very heavily infested areas, those along the border being kept separate. In those border areas that were moderately attacked collection was only carried out for about 1½ hours in the early morning and in the evening; adults composed the bulk of these catches. To check this work a gang of special collectors went over the border areas once every 3 or 4 days. As regards other parts of the estate, moderately infested gardens were visited once daily and more heavily infested ones two or three times a day. Collection was done on all possible occasions, by as many workers as possible, and in nearly all weathers. European supervision was constant. Pruning was done with the wind, as advised by Leefmans [see this *Review*, Ser. A, v, p. 416].

A comparison between a portion of this estate and a similar portion of a neighbouring one—where the campaign was not so intensive and cost only three-fifths as much—shows that the value of the increased yield was three times that of the extra cost, and furthermore that the estate was rendered a more valuable property.

Canter Visscher (W. A. E. A.). **Het Uitzwavelen van zwaar aangetaste Tuinen.** [The Sulphur Fumigation of heavily attacked [Tea] Gardens.]—*Meded. Proefstation voor Thee, Buitenzorg*, lvi, 1917, pp. 16–20.

On certain estates sulphur fumigation has proved very useful against *Helopeltis*. Coolies placed in a circle around an infested plot were provided with sticks to which sulphur cartridges were attached. A cartridge could thus be held beneath each bush or twig. The men gradually advanced towards the centre of the circle until the whole plot had been fumigated. If the right time is chosen (about 6 p.m.) the fumes will hang about the bushes for a considerable period. Each plot was fumigated thrice on three consecutive afternoons using 11 cartridges an acre each afternoon. After a 5-day interval, during which collection was effected daily, this triple fumigation was repeated and again followed by collection for five days. As a result the normal collection of *Helopeltis* was soon found to require only 7 women for 4 acres owing to the limited number of insects present. In the event of a windy afternoon fumigation may be carried out on the following morning from 6 to 7 a.m., but is less satisfactory. On one estate this operation was carried on for a period of six weeks on two occasions only in 8 years, and the 700 acres concerned are still free from *Helopeltis*. In another case six weeks a year was found necessary. The cost of the sulphur cartridges was about 48*s*. an acre for the six weeks, that of wages being about 11*d*. an acre for each day of fumigation. Collection is a valuable measure during the East Monsoon [dry season] and even if only a few specimens are captured then, the work is valuable, as these are the brood-mothers giving rise to the individuals that occur in the rainy season. The plants were also carefully manured so as to promote vigorous growth. Prunings and other rubbish were burnt without delay.

As pointed out by Dr. Bernard in his preface to this and the preceding paper, the success of this fumigation is evidently due to the circumstance that the infested plots were of a size permitting them to be surrounded by the operators.

Mally (C. W.). **Finely-powdered Mercuric Chloride ($Hg. Cl_2$) for the Destruction of the Argentine Ant, *Iridomyrmex humilis*, Mayr.**—*S. Afr. Jl. Sci., Cape Town,* xiii, no. 11, July 1917, pp. 565–567.

Good results against the Argentine ant, *Iridomyrmex humilis*, as a household pest, have been obtained with a tape consisting of strips of cotton cloth thoroughly soaked in a saturated solution of corrosive sublimate and then dried. Its repellent action is probably due to minute sublimate crystals on the surface of the cloth coming into contact with sensitive tissue on the feet or antennae of the ants; and there is also the possibility that the insects may poison themselves in attempting to clean their feet and antennae by drawing them through the mouth.

This having suggested to the author that the use of finely powdered corrosive sublimate would yield even better results, the opening of a nest near the base of a large oak tree was experimentally surrounded with a half-inch barrier of the substance about an hour before sundown. The results of this and many similar experiments show that the ants become excited and confused before touching the powder, probably owing to the presence of very fine particles in the air, with the result that they attack and mutilate one another and refuse to cross the barrier, while many are poisoned, probably in the attempt to clean themselves.

The poison is more active in sunlight than in the shade and retains its effectiveness for as long as eight or nine months. Light rains carry it into the soil, but on evaporation it is again deposited on the surface in a finely crystalline condition. This suggests the possibility of treating the foundations of buildings, either during construction or afterwards, with corrosive sublimate in solution as a preventive against the invasions of ants.

Mally (C. W.). **A Convenient Type of Hydrocyanic Acid Gas Generator for Fumigating Vineyards for the Destruction of the Mealy Bug, *Pseudococcus capensis*, Brain.**—*S. Afr. Jl. Sci., Cape Town,* xiii, no. 11, July 1917, p. 621, 2 plates.

The difficulty experienced in fumigating grape vines with hydrocyanic acid gas during the winter season for the destruction of *Pseudococcus capensis* (vine mealy bug), owing to the smallness of the space to be treated within the long, low, narrow, oiled canvas covers used for trellis or stump vine treatment, has necessitated the adoption of a new form of generator. In this a solution of potassium cyanide is used to combine with the acid, thus obviating the loss of time incurred in weighing or measuring off small quantities of chemicals. It consists of a cylindrical leaden chamber, the upper portion of which forms a detachable lid pierced by small holes on opposite sides near the top, into which are fixed a pair of vertical tubes, one for the acid, the other for the cyanide solution.

To charge it the lid is held upside down and the tubes are filled with the proper amount of the liquids; the body of the generator is then inverted over it and pressed into position. When the gas-tight cover is in position over the vine, the generator, still inverted, is placed

beneath it and rapidly turned right side up, the hand being quickly withdrawn and the opening in the tent closed. The gas is generated instantaneously and escapes in jets from the lateral openings.

The advantages of this form of generator are that it involves no loss of time or of gas, and that it is easily cleaned and is strong enough to withstand rough handling in the vineyards, while the lateral openings utilise the force of chemical reaction to ensure the rapid diffusion of the gas.

DUTT (H. L.). **The Greasy Surface Caterpillar: its Life-History and Seasonal History.**—*Agric. Jl. Dept. Agric. Bihar & Orissa, Patna*, v, no. 1, April 1917, pp. 1–14. [Received 2nd March 1918.]

Agrotis ypsilon (greasy cutworm) is a pest of major importance damaging tobacco, potato, pea, wheat, gram, lentil, mustard and linseed crops [see this *Review*, Ser. A, i, p. 507]. The length of the incubation period is influenced by temperature and moisture, varying from 2 days in April to 4–6 days in the winter months, when the chances are more in favour of trapping the adult before oviposition. The larvae can be reared experimentally on maize, sugar-cane, cucurbits and cassava in addition to their usual food-plants. The larval stage varies in length from 19 days in summer and the rains, to 47 days in the coldest months. When in large swarms the keen struggle for existence compels them to abandon their habit of feeding only at night. The cannibalistic habit, for which this caterpillar is notorious, increases with its development, being quite absent in newly-hatched larvae. The pupal stage, which varies in length from 9 days in April to more than a month in December, is passed in a smooth hard earthen cell, quite imperceptible in hard clay soil, and only slightly in evidence in loamy soil. The adults, which are nocturnal in habit and have a marked repugnance for sunlight, are more active in moist than in dry weather. Under insectary conditions the length of life of a female moth varies from 10 to 14 days, that of the male being much shorter. The adults emerge during August, reach a maximum in December and finally disappear some time in April, apparently aestivating in the adult stage, probably in thatched huts or in buildings of villages adjacent to the low flood-lands.

The pest is best controlled by means of Andres-Maire traps and by hand-picking the first brood larvae [see this *Review*, Ser. A, iii, p. 321, and iv, p. 418].

Studies are now being made of two Hymenopterous and one Tachinid parasite, an account of which will be published as soon as the work is completed.

MACKIE (D. B.). **Some Causes of the Failure of the Manila Cigar on the United States Market and a Remedy.**—*Philippine Agric. Rev., Manila*, x, no. 3, 1917, pp. 223–252. [Received 2nd March 1918.]

The most important enemy of the cigar manufacturer in Manila is the cigarette beetle, *Lasioderma serricorne*, which is more prevalent in some years than others.

The microscopic eggs are laid singly in wrinkles or folds of the dried leaf. The larval stage lasts 151 to 170 days. Pupation takes place

in a cell composed of frass and minute particles of tobacco, eleven days being passed in the pupal stage. The adult beetles are small and active, especially in the afternoon and at night, and are attracted by lights. The insect does not feed during the adult stage, the perforations in cigars being made by the emerging adults.

The fluctuation in the numbers from year to year seems to be influenced by the amount of rain during the growing season. When this has been wet, the leaves are thin and silky and a considerable percentage of their natural resins have been washed away. After a very dry season the crop is rich in natural resins, the stickiness of the leaves being more pronounced, and this acts as a mild repellent.

Since the beetle attacks the leaf soon after it has been harvested, it is present in the tobacco before it is baled, and, being baled with it, is widely distributed, each factory receiving a new infestation with every bale received. The damage done depends entirely on the length of time that elapses before the baled tobacco is used. Theoretically it should be possible to control the pest either in the baled tobacco, or in the finished cigar, but in practice the former method is impossible, as the beetles are constantly flying and breeding in the factories, which are so constructed as to render their extermination impracticable.

It is known that the beetle cannot enter boxed cigars as prepared for the market, hence it can be controlled with certainty by treating the finished cigars. The method successfully employed consists in fumigating the cigars when packed in boxes, with carbon bisulphide in a vacuum. The container, which can hold 40,000 cigars at once, is partly exhausted, causing the distension of the beetles in whatever stage they may be. On opening the generator the gas rushes in, penetrating to the smallest interstices of the cigars and permeating the organism, whether egg, larva, pupa or adult. Exposure for one hour to the gas at the rate of one pound carbon bisulphide per 150 cubic feet has been found sufficient for all purposes, the gas being pumped out and the chamber filled with air before removing the cigars. In the case of baled tobacco it is better to allow the gas to remain instead of pumping it out.

Damage to baled tobacco might also be greatly reduced by packing up the bales in coarse cotton cloth, on which the beetles find it difficult to walk, instead of in the usual loose banana plait.

WESTER (P. J.). **A Possible Factor in Coconut-beetle Control.**—*Philippine Agric. Review, Manila*, x, no. 3, 1917, pp. 299–300. [Received 2nd March 1918.]

A natural enemy of the coconut beetle [*Oryctes*] in the Philippines has been found by Mr. F. Warner in the island of Bohol. This is a flying lemur, *Galeopithecus* sp., which has been domesticated by the Filipinos, and bred, partly for the value of its skin, which is used for the making of hats, and partly for catching coconut beetles. This small animal is insectivorous and harmless, the only vegetation eaten by it being the leaves of the jak, *Artocarpus integrifolia*. Nothing is known of its breeding habits. Its flesh is said to be poisonous, which renders it unlikely to have many natural enemies, so that if it can be multiplied rapidly and if, as reported, it is of a non-roving disposition, it should prove of value in the control of the beetle.

OSHIMA (M.). **Notes on a Collection of Termites from Luzon, obtained by R. C. McGregor.**—*Philippine Jl. Sci., Manila*, xii, sec. D, no. 4, July 1917, pp. 221–225, 1 fig. [Received 2nd March 1918.]

The termites dealt with in this paper are :—*Calotermes* (*Neotermes*) *malatensis*, sp. n. ; *Coptotermes travians*, Hav. ; *Termes* (*Macrotermes*) *philippinensis*, Oshima ; *Eutermes* (*Hospitalitermes*) *luzonensis*, sp. n. ; *E. balintauacensis*, sp. n. ; *E. minutus*, Oshima ; and *Microcerotermes losbanosensis*, Oshima.

BACK (E. A.) & PEMBERTON (C. E.). **The Mediterranean Fruit Fly in Hawaii.**—*U.S. Dept. Agric., Washington, D.C.*, Bull. no. 536, 26th January 1918, 119 pp., 21 plates, 24 figs., 32 tables.

This lengthy and well-illustrated bulletin deals exhaustively with the subject of the Mediterranean fruit-fly (*Ceratitis capitata*, Wied.) in all its bearings. Much of the subject-matter has already been noticed [see this *Review*, Ser. A, iii, pp. 332, 374, 412 ; iv, pp. 134, 289 ; vi, p. 167]. Stress is laid on the point that control must be by means of natural enemies, artificial control being practically impossible under the conditions existing in Hawaii. A complete list of the Braconid, Proctotrupid, and Chalcidid parasites of the fruit-fly, as recorded by Silvestri, is given, to which should be added *Pachycrepoideus dubius*, introduced from the Philippines during the early part of 1914.

The life-histories of the following parasites are described :—*Tetrastichus giffardianus*, Silv., which, previous to his published description in 1915, Silvestri had confused with *T. giffardi*, hence references to *Tetrastichus* as a parasite of *Ceratitis capitata* in Hawaii should be taken to refer only to *T. giffardianus* ; *Opius humilis*, Silv. ; *Diachasma tryoni*, Cam. ; and *D. fullawayi*, Silv.

At present a struggle for supremacy is taking place between *Opius humilis* on the one hand, and *Diachasma tryoni* and *D. fullawayi* on the other, the latter two having the advantage of possessing much longer ovipositors, by means of which they are able to reach their host larvae through the tissues of infested fruits, while the greater hardiness and more rapid development of *O. humilis* are points in its favour. This advantage is however nullified by its cannibalistic habits, which impel it to destroy earlier hatched larvae of its own species within the same host. During the summer, when *D. tryoni* matures more rapidly, it attains an ascendency over *O. humilis*, which is again reversed during the winter months. Should *D. fullawayi* become thoroughly established, it will probably supplant *D. tryoni*, as it gives promise of being a most efficient parasite of the fruit-fly, especially in coffee berries.

Instead of supplementing the work of the Opiines, *Tetrastichus giffardianus* will probably prove a competitor, its larvae being able to hold their own against Opiine larvae in the same host, usually causing their death. Neither this species nor *Pachycrepoideus dubius* is yet present in sufficient numbers to be an effective factor in control.

It has been found necessary to omit from this bulletin a bibliography of about 350 references, accompanied by a brief résumé.

PEMBERTON (C. E.) & WILLARD (H. F.). **Interrelations of Fruit-fly Parasites in Hawaii.**—*Jl. Agric. Research, Washington, D.C.*, xii, no. 5, 4th February 1918, pp. 285–295, 4 plates.

The recent introduction into Hawaii of four species of larval parasites of the Mediterranean fruit-fly (*Ceratitis capitata*, Wied.) has shown that, to quote Dr. Howard, "it is unwise and most unpromising to attempt heterogeneous and miscellaneous importations of parasites without careful study of the host-insect on its home ground and in its natural environment throughout the whole range of its existence, and a similar biological study of its parasites and natural enemies under such conditions."

In 1913 two species of Opiine parasites of the fruit-fly were introduced into Hawaii by Prof. F. Silvestri, *Opius humilis*, Silv., from South Africa, and *Diachasma tryoni*, Cam., from Australia. In the course of two years it was quite evident that *O. humilis* was often parasitising from 60–90 per cent. of all the fruit-fly larvae developing in coffee berries. *D. tryoni* slowly but steadily increased and ultimately showed a capacity for occasionally parasitising 50 per cent. or more of the host-larvae.

Examination of parasitised larvae showed that when, attacked by both species of parasite, in the majority of cases *O. humilis* was killed and *D. tryoni* alone developed to maturity. This was due to the fact that the newly hatched *D. tryoni* larvae are very active and well protected ventrally by a thick mass of scrosal material and provided with very powerful hooked mandibles, while *O. humilis* larvae are sluggish, not so well protected ventrally, and have less powerful mandibles. In the second instar both species lose their powerful head armature and become helpless, enlarged and stiffened. Hence, if, as is often the case, several eggs of these two species are deposited in the same host, the last parasite to hatch stands the best chance of destroying the others and maturing.

Both these species, as well as *D. fullawayi*, readily oviposit in the same larva, showing no selection of parasitised or unparasitised larvae, as many as 8 or 10 Opiine larvae being frequently found in the same host. The mere deposition of 8–10 parasite eggs often causes the death of the fruit-fly larva, and though all these eggs hatch out, the resulting larvae die off in a short time.

Cool weather retards the development of the Opiine egg, especially that of *D. tryoni*, and this fact causes a seasonal rise and fall in the effectiveness of *O. humilis*. In the summer and autumn the ascendancy of *D. tryoni* causes a great reduction in the abundance of *O. humilis*, which is reversed during the winter and spring by the reduced activity of *D. tryoni* permitting a rapid increase in parasitism by *O. humilis* [see this *Review*, Ser. A, vi, p. 167].

The recent introduction of another fruit-fly parasite, *Tetrastichus giffardianus*, Silv., has shown that this Chalcid is decidedly destructive to any of the Opiines occurring with it in the same fly larva or puparium. In oviposition, about 10 eggs are placed in the host at one insertion of the ovipositor, whereas *O. humilis* lays only one. Hence, though soft, sluggish, devoid of cannibalistic tendencies, and armed with small, inconspicuous, blunt mandibles, it nevertheless survives the Opiine larvae by sheer force of numbers. If the host-larva is already

parasitised by *O. humilis* or *D. tryoni*, the death of these usually results from starvation or suffocation or possibly by the absorption of toxic excretions of the *Tetrastichus* larvae. Since this parasite does not exert any perceptible control of the fruit-fly, its introduction must be regarded as detrimental owing to its interference with the work of *O. humilis*.

The superiority of *O. humilis* over the other introduced fruit-fly parasites in Hawaii is clearly proved, and the decided restraint placed upon it by the unfailing cannibalistic activities of the larvae of *D. tryoni* in particular, and of other parasites in part, show that results detrimental to a certain extent have arisen from the liberation of parasites other than *O, humilis*, the value of which has been reduced to that of a secondary parasite.

McKay (J. W.). **Annual Report of the Karimganj Agricultural Experiment Station for the Year ending the 30th June 1917.**—*Ann. Rept. Agric. Expts. & Demonstrations in Assam for the Year ending 30th June 1917, Shillong*, 1917, pp. 68–82. [Received 12th March 1918.]

The control of hairy caterpillars infesting the jute crop has been successfully effected by hand-picking the leaves on which the newly-hatched larvae were clustered, and placing them in hot water or kerosene.

The rice bug (*Leptocorisa varicornis*) is the cause of immense annual loss to the rice crop, but is effectively checked by the following method: Two boys take a light cloth about 15 ft. long and 4 ft. wide, holding the opposite ends with a corner in each hand. By approaching the hands to a distance of 18 inches they form a long narrow bag with which they sweep across the tops of the plants by running quickly up and down the plot. The bag is then closed and twisted at each end to destroy the many bugs that are captured in this manner.

The adult moths of the stem-borer are easily destroyed by means of a lamp suspended over a barrel of water covered with a light film of kerosene.

Insect Pests of Tea in North-East India during the Season 1916.—*Qtrly. Jl. Scient. Dept. Indian Tea Assoc., Calcutta*, Pt. 3, 1917, pp. 75–79. [Received 12th March 1918.]

The insects attacking tea in North-East India in 1916 were: *Helopeltis theivora*, Waterh. (tea mosquito) which, though it did no damage of exceptional severity, occurred in districts usually considered free from attack; *Empoasca flavescens*, F., of which unusually severe attacks were experienced in some districts, generally following severe hail; *Tetranychus bioculatus*, W.-M. (red spider), which was less serious than usual; *Heterusia magnifica*, Butl. (red slug), the damage done by which was negligible; *Biston suppressarius*, Guen. (looper), which occurred in much smaller numbers than in 1915; *Clania* spp. (faggot and bag worms) and *Thosea* spp. (nettle-grubs), little damage from which was reported; *Physothrips setiventris*, Bagn., and an undescribed species of thrips, the attacks of which were of normal intensity; *Brachytrypes achatinus*, Stoll (cricket), reported as causing damage in nurseries; and *Termes (Odontotermes)* sp. (termites), which

were serious pests in one district. Other pests reported were: borers, *Andraca bipunctata*, Wlk. (cluster caterpillar), *Poecilocoris latus*, Dall. (tea-seed bug), and the scale-insect, *Tachardia* (*Carteria*) *decorella*, Mask.

Observations on the Lime Industry.—*Rept. Agric. Dept. Montserrat, 1916–1917*; *Barbados*, 1917, pp. 12–14. [Received 7th March 1918.]

The failure of young lime trees in recent years appearing to be generally associated with severe infestations of purple scale [*Lepidosaphes beckii*], trials have been made of growing sugar-cane, pigeon pea and Bengal beans between young trees to afford shelter and shade and assist in the control of the insect. The result of these experiments showed that the trees interplanted with pigeon peas made more growth, and showed greater vigour, and also considerably greater immunity from the development of purple scale, than did those sheltered by Bengal beans.

Of young trees planted in July 1915, those showing signs of infestation were sprayed with the insecticide "Scalo" seven times during the year March 1916–March 1917, with the result that the trees were kept in tolerable health for twenty months after planting, while unsprayed trees planted at the same time suffered from severe attacks of scale-insects and showed the usual decline.

Owing to the damage to the roots of lime trees by the grubs of the weevil, *Diaprepes* (*Exophthalmus*) *esuriens*, weekly hand-picking of the adults was carried out during the year May 1916 to May 1917, the total number being 8,655, of which the majority was collected in May and July and the smaller number from January to May. As the eggs of this weevil are laid on the leaves and the young grubs fall to the ground in the vicinity of the roots, the value of this work is at once apparent.

Work connected with Insect and Fungus Pests and their Control.—*Rept. Agric. Dept. Montserrat, 1916–17*; *Barbados*, 1917, pp. 26–29. [Received 7th March 1918.]

During the season cotton-stainers [*Dysdercus*] caused a loss to the island of approximately £1,800, though, fortunately, the period of greatest abundance occurs after the greater part of the crop has been gathered, thus emphasising the need for early planting. From January to May the insects are always more or less associated with *Thespesia populnea*, which however occurs only in small numbers on the island. In April and May it is also found on the silk-cotton tree (*Eriodendron anfractuosum*), which is fairly plentiful, but acts as a host-plant only when bearing pods. Legislative action to enforce the destruction of these two trees is being delayed, pending the result of such action in St. Vincent. The insect has also been found in small numbers on Malvaceous plants during April and May, and on its first appearance daily hand collection should be at once undertaken.

In November 1916 a field of maize was found to be badly infested with the corn leaf-hopper (*Peregrinus maidis*), which is normally controlled in Trinidad by Hymenopterous parasites. This is probably the case in Montserrat also, since this is the first recorded instance of damage to crops.

HUTSON (J. C.). **The Sweet Potato Root Weevil.**—*Agric. News, Barbados,* xvii, no. 412, 9th February 1918, pp. 42-43, 1 fig.

The sweet potato root weevil (*Cylas formicarius*) is a pest that cannot be eliminated from a district where it has become well established, though much may be done to reduce the damage caused by it. According to Mr. Wilmon Newell this pest is disseminated by the movement of infested sweet potatoes, both tubers and plants, from one district to another and not by flight, the adults, although possessing well-developed wings, having rarely been observed to fly. The favourite host-plants are the sweet potato (*Ipomoea batatas*) and the morning glory (*Ipomoea* sp.), though the adults can feed on a great variety of vegetation. This weevil is remarkably free from natural enemies, no parasites or birds predaceous on it having been recorded. Of artificial control methods, quarantine measures are the most important, those adopted by the Plant Board of Florida having already been noticed [see this *Review*, Ser. A, vi, p. 40]. Fumigation of the tubers destroys the insect in all its stages, using carbon bisulphide at the rate of 3 lb. to each 1,000 cubic feet of space. Damage done by the weevil and also by the scarabee or Jacobs [*Euscepes batatae*] can be greatly reduced by clean cultivation methods, such as using only those plants that are known to have come from a weevil-free locality; collecting and burning all vines, damaged tubers, pieces of root, etc., after harvesting the crop; burning damaged sweet potatoes, or boiling them if they are needed for feeding stock; preventing the spread of the insect by separating the sweet potato patches as widely as possible and not planting the crop on the same land for two successive seasons.

BRUCH (C.). **Metamórfosis de *Pachyschelus undularius*, Burm. (Coleóptero bupréstido).** [Metamorphosis of the Buprestid, *Pachyschelus undularius*, Burm.]—*Physis, Buenos Aires,* iii, no. 13, 17th March 1917, 2 plates. [Received 7th March 1918.]

The small Buprestid, *Pachyschelus undularius*, lives on *Sapium biglandulosum*, which is common in the forests around Buenos Aires and La Plata. Adults are found during the summer, in December and January, upon the leaves of the host-tree, while the white froth on the leaves reveals the presence of the larvae, which devour the parenchyma of the leaves. While mining between the two surfaces of the leaf, the larva throws out an abundant latex on to the surface. This habit has been noticed in the case of larvae of other Coleoptera, and particularly very recently in the case of an allied Buprestid of the same genus from Paraguay. Eggs are laid on the under-surface of the leaf, the female making a number of incisions in the leaf to facilitate the work of the newly-hatched larva. The egg hatches after 5 to 6 days and the larva develops rapidly, reaching maturity in about two months. During this period a great quantity of froth is thrown out on to the surface of the leaf. Upon reaching maturity, the larva constructs a sort of disc at the end of its mine in which it transforms into a nymph. Under this disc it may remain from ten days to two months in a quiescent state before pupating. The

pupal stage varies from two to several weeks according to the season. The shortest life-cycle observed occupied one month. Detailed descriptions of the various stages of this beetle are given.

von Ihering (R.). **Observações sobre a Mariposa** ***Myelobia smerintha*****, Hübner, em São Paolo.** [Observations on the Moth, *Myelobia smerintha*, Hübn., in São Paolo.]—*Physis, Buenos Aires*, iii, no. 13, 17th March 1917, pp. 60–68. [Received 7th March 1918.]

The Pyralid, *Myelobia smerintha*, Hb., is well known in São Paolo, Santos and Rio de Janeiro as a nocturnal plague in the towns, which are invaded by swarms of the moths for about a week at a time. As the adults are strongly attracted to lights, an apparatus for catching them is fixed to the street-lamps and by this means some 855 moths have been caught within the space of four hours. The larvae, which incidentally have been proved to be edible and nutritious and are considered a delicacy by many native tribes, live in the stems of various Brazilian canes. In the course of his observations, the author has found many insects and other Arthropods inhabiting the nodes of these canes; in particular a cane of the genus *Chusquea* was found to harbour two species of Pentatomid bugs that apparently pass the whole of their adult life in the canes, the entrance holes frequently being too small for any but quite young larvae to penetrate. The scale, *Ripersia taquarae*, Hempel, is also found among the frass formed within punctured canes.

Myelobia smerintha is found in large numbers in a cane which has been identified as *Merostachys clausseni* var. *mollior.* Most varieties of cane are largely adapted to agricultural uses and this one in particular is very valuable for making baskets, hampers, etc. In the years when this cane blooms it dries up and dies, and it is only after a long interval that it springs up again in the same place. The flowering of the cane, which only occurs once in several years, is apparently determined by prolonged droughts, and occasionally by other climatic factors that stimulate the plant to perpetuate itself by seeding at a time when general conditions are unfavourable for its propagation by rhizomes. In all probability a similar reaction occurs when the larvae invade the cane stalks, causing damage which would prove fatal to the plant; this would explain the fact that the emergence of *M. smerintha* has as yet only been observed in flowering canes. Eggs are deposited in large quantities on the leaves of garden plants, for preference on the large leaves of *Agave americana*, and hatch in a little over a week. The larvae from these, not finding a suitable environment, descend by silken threads presumably in search of their normal food-plants. From these observations it is concluded that under normal circumstances the female oviposits on the upper parts of the canes and the resulting larvae then descend by threads until they reach a suitable internode, the preference apparently being for those that are three feet or more above the ground level. Probably the larva then bores its entrance-hole, and having entered the cane it seals the opening up with a silken web and feeds upon the internal tissues, a large amount of frass and residue forming at the base of the internode. In spite of this, the internodes inhabited by a larva frequently appear to be intact, and sometimes have to

be broken open to detect the presence of the insect. Emergence of the adults occurs in late September or early October, all the moths appearing within a week of one another. In 1914 it was observed that the invasion of a town came from canes at a distance of 11 miles in a straight line, whence the lights of the town were distinctly visible. That *M. smerintha* can fly great distances is also proved by an individual having heen captured at sea out of sight of land near Rio de Janeiro.

In spite of their secluded existence, the larvae do not all develop into adults; some die in the larval stage, others, after pupation, fail to force the way through the exit-hole, while rats destroy a certain number by breaking open the canes.

These observations differ in a few minor points from those made in 1903 by Dr. Basilo Furtado: the eggs, for example, are laid on leaves of various plants, and presumably on cane in normal conditions, and not on the ground near to the canes as previously recorded. Several points remain to be elucidated. After blooming, the cane dies and the moths emerging from it are obliged to seek other canes on which to oviposit. It is not known how they find these, which are frequently at some kilometres distance. It is not known when pairing takes place; in their flights through towns they have never been observed *in coitu*, the females usually being already fertilised. The actual method of oviposition has never been observed, nor the manner in which the newly-hatched larva penetrates the cane. The length of the larval stage and of the pupal stage are also unknown. The reason for the sudden invasions of the towns, at intervals of some years, remains to be discovered. These invasions have been observed simultaneously in São Paolo, Santos and Rio de Janeiro, and cannot be attributed to favourable local conditions such as abundance of cane. In São Paolo, large swarms occurred in 1910 and 1914; in the intermediate years the moths appeared at the same time but in much fewer numbers; at other times it was very rarely that even a single example was seen.

PAILLOT (A.). *Perezia legeri*, **sp. n., Microsporidie nouvelle, Parasite des Chenilles de** ***Pieris brassicae.*** [*Perezia legeri*, a new Microsporidium parasitic in the Caterpillars of ***Pieris brasssicae.***]—*C. R. Soc. Biol., Paris,* lxxxi, no. 4, 23rd February 1918, pp. 187–189.

This microsporidium is met with in caterpillars in the adipose tissue and in certain giant cells in the blood. The cause of the hypertrophy of the blood cells to form the typical giant cells is at present unknown. Probably it is not due to the endocellular parasite itself, since these cells are found in non-parasitised caterpillars. Possibly there may be some connection between them and the larvae of *Apanteles*, an extremely wide-spread entomophagous parasite of the caterpillars of *P. brassicae.*

GAUTIER (C.). **Etudes physiologiques et parasitologiques sur les Lépidoptères nuisibles. Sur quelques Faits relatifs aux Larves de Piérides.** [Physiological and Parasitological Studies on Injurious Lepidoptera. On some Facts relating to Pierid Larvae.]—*C. R. Soc. Biol., Paris,* lxxxi, no. 4, 23rd February 1918, pp. 197–199.

A large proportion of the larvae of *Pieris brassicae* are parasitised

by the Braconid, *Apanteles glomeratus*. The number of parasitic larvae present in one caterpillar is often as many as 50 to 60, even 80 having been known to emerge from a single host. Opinion is divided as to the time of attack by the parasite. Some observers think that oviposition takes place on the larvae, others in the egg. A similar divergence of opinion exists as to the time of emergence of the parasite, some authorities stating that they issue from the pupa, the others that they emerge from the larvae, which die when ready to pupate, and others that they leave their host when the latter ceases to feed in preparation for metamorphosis.

The author has never seen the larvae emerge from the pupae; the infested larvae cease to feed and after weaving some threads remain motionless while the parasitic larvae emerge, and using these strands as a support, spin their own cocoons beneath the body of the caterpillar; the latter remains motionless for a day or two and finally dies; the strands of tissue formed by the caterpillar are not indispensable to the larvae in spinning their cocoons. The method of controlling *Pieris brassicae* by crushing the caterpillars on the leaves of the host-plant should be avoided, as it results in the destruction of innumerable useful parasites.

FEYTAUD (J.). **Le Ver des Pommes (*Carpocapsa pomonella*, L.).** [Apple Worm (*Cydia pomonella*, L.)].—*Bull. Soc. Etude Vulg. Zool. Agric., Bordeaux*, xvii, no. 1–2, January-February 1918, pp. 1–9.

This paper gives a résumé of the life-history and control of *Cydia pomonella* in view of the importance of the production of food of all kinds at the present time. The best measure is spraying with lead arsenate according to the formula ⅗lb. disodic orthoarsenate and 2 lb. neutral lead acetate, yielding by double decomposition about 1½.lb. lead arsenate, to 22 gals. water, the wetting power of the solution being increased by the addition of ½ lb. of adhesol. This should be applied by means of a portable spraying machine soon after the fall of the petals, the quantity and weight of apples harvested in October being more than doubled by treatment at this stage, while spraying delayed till a fortnight after flowering, increases the yield by only 10–20 per cent. The best results as to total weight of fruit, and weight of sound fruit, are obtained by spraying at both these times, the yield of sound fruit being increased six-fold.

This pest has several natural enemies, including birds, spiders and numerous parasites, especially the Hymenoptera, *Campoplex pomorum*, Ratz., *Pimpla roborator*, F., *Ephialtes carbonarius*, Zach., *Pristomerus vulnerator*, Panz., *Stylocryptus brevis*, Grav., *Phygadeuon varicornis*, Thoms., *Hemiteles inimicus*, Grav., *Microdus conspicuus*, Wesm., *Ascogaster rufipes*, Nees, *Perilampus laevifrons*, Dalm., *Dibrachys boucheanus*, Ratz., *Trichogramma* (*Oophthora*) *semblidis*, Auriv., and *Inostemma bosci*, Jur., and the Tachinid fly, *Leskia aurea*, Fall.

Report of the Proceedings of the Second Entomological Meeting held at Pusa on the 5th to 12th February 1917.—*Calcutta*. 1917, 340 pp., 34 plates. Price 4*s*. 6*d*. [Received 1st March 1918.]

This report, prepared and edited by T. Bainbrigge Fletcher, the Imperial Entomologist, is based partly on notes made before the meeting

and partly on a running abstract made during the meeting by the secretary. The record is given as fully as possible, so that the report constitutes what is practically a review of current knowledge of Indian crop-pests.

The insects are dealt with under the headings of the crops they attack, including hill crops, leguminous field crops, oil-seeds, Malvaceae, fibre-plants, sugar-cane, rice and other cereals, grasses and fodder crops, fruit-trees, palms, garden plants, drugs and dyes, Cruciferous crops, other vegetables and condiments, and stored products. Numerous coloured plates are included in the report and many references to former publications have been added to make it as complete as possible. An adequate index is appended.

Soler i Coll (J. M.). **Es necesario proteger á los Pájaros.** [It is necessary to protect Birds.]—*Rev. Inst. Agric. Catalan de S. Isidro, Barcelona*, lxvii, no. 4, 20th February 1918, pp. 56–59.

Attention is called to the fact that though Spain is a signatory to the International Convention of 1902 for bird protection and though it has its special legislation in the matter, the rules adopted are largely disregarded. Statistics are quoted showing the great importance of birds in combating injurious insects and a list of useful Catalonian birds is given.

Cooley (R. A.). **Economic Entomology in the Service of the Nation.** —*Jl. Econ. Entom., Concord, N.H.*, xi, no. 1, February 1918, pp. 16–28.

In this paper, which formed the Presidential Address to the American Association of Economic Entomologists, the present status of economic entomology is reviewed in the light of the national emergency and in view of the outstanding necessity for service to the nation during the war. While enjoying a rapid growth, it is only too obvious that economic entomology is at present incompletely organised, and entomologists are urged, if necessity arise, willingly to throw traditions aside and approach new problems with open-mindedness. The scope and importance of entomological service in the national welfare is twofold, covering as it does the fields of agricultural and medical entomology. With regard to crops, it has frequently been estimated that the annual losses due to the depredations of insects amount in the United States to at least 10 per cent. of the total value of the crops. If this additional 10 per cent. could be saved, it might be enough to turn the balance in the war. The great question to be faced is whether entomologists can materially reduce this waste by special emergency efforts, or whether the American people can become organised to accomplish this end. The most urgent demand, in view of the world shortage of agricultural products, is on that branch of the service known as extension entomology, that is, an organised effort to impress upon every individual farmer and landowner the practical importance of entomology as an aid to the increase of our food supplies. Great encouragement has been given to this branch of the subject by the passing of the Smith-Lever Act and by a special emergency fund to be used for extension or control work on insects.

It is of the greatest importance that, while giving special attention to present needs, the future necessities of the nation should not be overlooked, and the foundations for a permanent extension system in entomology should now be laid. More effective organisation of official work in economic entomology is undoubtedly required; in the States there is a greater variety of types of organisation than is warranted by their needs. This applies particularly to horticultural inspection work, where there are frequently several individuals or bodies all doing much the same class of service. The opportunity now occurs to organise extension schemes that shall be as uniform as possible. Data have been collected from several States regarding the status of organised State extension work, and this is included in a table.

Research and experimentation have gone far ahead of extension, and entomologists are in possession of a great deal of valuable information which the farmer is either entirely ignorant of, or does not perfectly understand. This results in the continuation of losses that might be prevented. There is still a great tendency to overlook average losses and pay attention only to conspicuous outbreaks of pests. A large and rapidly increasing number of county agents have been recently appointed in various States; co-operation and organisation are again required, and it is suggested that extension divisions should be established in the entomological departments connected with the land grant colleges Agreements are projected between the Bureau of Entomology and the extension services of several States. An increase in production in any given State can frequently be planned in advance, but insect outbreaks are often sporadic and always regional, and the Bureau of Entomology reserves the right to detail the specialist to another State if necessary. It is considered of the utmost importance that each State should have its own extension entomologist, and not trust to securing one of the specialists from the Bureau in any emergency. Such a specialist when called upon can work much more effectively in co-operation with a local man who is following a comprehensive plan for meeting the needs of the State.

The extension entomologist has many means by which he may work towards his end of saving as much as possible of the 10 per cent. loss. He may work through the farmer himself, or by the method of educating the children in the schools. Other methods include lectures, circulars, and the agricultural and general press, demonstrations, exhibits and charts, and the preparation of text-books for public instruction. The farmer should not only be shown what he must do, but should be persuaded to do it, and convinced of the advantage accruing to himself.

While the control of insect pests cannot be reduced to definite rules, some standardisation of methods is distinctly desirable. There should be a general and official adoption of uniform or standard remedial measures for as many as possible of the insect pests, and these methods should form the basis of public instruction. An entomologist's recommendations frequently lack definiteness. Several methods are perhaps recommended by one or more specialists and the farmer is left to choose for himself, with the result that he frequently tries none of them. He is not likely to be able to decide between remedies when the entomologist has failed to do so. Any standard

control method will necessarily be liable to variation with the climate, number of generations and other known factors in different neighbourhoods.

There has been an increasing tendency on the part of the public, largely owing to the increasing shortage of food, to demand a slackening of inspection and quarantine regulations. International commerce has been revolutionised during the War, and what future changes will occur cannot be foreseen, but it is clear that the inspection service will be greatly needed. The great probability is that there will be a serious shortage of suitably trained entomologists and teachers of entomology during the next ten years; it is suggested that renewed attention should be given to the further development of means and methods of teaching entomology in the college and university. Men who will regard the broader aspects of the science are required at the head; local interests must be submerged in order to promote the general welfare and produce the fullest service that economic entomology can render to the nation.

During the discussion following this address, it was suggested that other States would do well to follow the lead of Illinois, where a law has been passed empowering the Director of Agriculture to issue a proclamation whenever an insect pest threatens serious injury, setting forth the measures that must be adopted to combat it, non-compliance with the law entailing prosecution.

Paddock (F. B.). **Texas Aphid Notes.**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 1, February 1918, pp. 28–29.

Although from time to time the occurrence of various Aphids in Texas has been recorded, no list of the species occurring in the State has been published. This family is however of considerable economic importance, the destructive species including *Toxoptera graminum*, Rond. (wheat aphis), *Aphis gossypii*, Glover (melon or cotton aphis), *Aphis pseudobrassicae*, Davis (turnip aphis), *Aphis padi*, L. (oat aphis), and *Aphis maidis*, Fitch (corn-leaf aphis). Of these, *T. graminum* is well-known as a serious pest, *A. gossypii* has caused the growing of melons and cucumbers to be abandoned in some districts, and *A. pseudobrassicae* has had a similar effect upon turnips. *A. padi* annually destroys acres of oats, while *A. maidis* stunts the growth of maize and of sorghum.

The most remarkable fact in the life-histories of these Aphids in Texas, is the absence of the sexual forms, it having been stated that south of the 35th parallel these forms have rarely been observed except at high altitudes. Although sexual forms of *A. padi*, *A. maidis* and *T. graminum* occur throughout the north, they have not yet been found in Texas, but further investigation on this point is necessary. Sexes of *A. gossypii* have not been found even in the north. In the species carefully investigated, including *T. graminum*, *A. pseudobrassicae* and *A. gossypii*, the normal form of reproduction is asexual throughout the entire year. Even close to the 34th parallel, viviparous reproduction among Aphids persists throughout the winter. Though temperatures of 15° to 20° F. are then not infrequent, *A. pseudobrassicae* and *T. graminum* survive, their reproduction being retarded. In the southern section of the State, where frost rarely

occurs, asexual reproduction proceeds without interruption. The summer conditions in Texas are more adverse to Aphids than winter ones. During the long, hot and dry summers, green succulent vegetation is found only in low, damp and sheltered places. Migration of *T. graminum* from grain occurs during June and July, when the grain is ripening. *A. pseudobrassicae* was reared with difficulty throughout the summer on turnips, when none were to be found in the field. *A. gossypii* feeds entirely on cotton and okra during the summer months, these host-plants being the only ones available at that time. In the case of *A. pseudobrassicae*, during the hot, dry weather there is a decided decrease in reproduction, all stages of the life-history being lengthened in much the same way as under winter conditions. The same observations have been made regarding *A. gossypii* in cage rearing experiments.

In the case of *Pemphigus betae*, Doan, (beet louse) there is a complete reversal of the life-history. The alate viviparous females of this species may be found on the foliage of turnips during October. The apterous females feed on the roots of this host throughout the winter, sometimes causing an appreciable loss in the crop. Alate forms are found on the foliage again in March and later on cottonwood. On this host, the summer is passed in galls on the leaves. No eggs of this species have yet been observed.

The economic problems resulting from the presence of Aphids in Texas have as yet received but little attention, and a great amount of work remains to be done, especially in connection with the alternative host-plants.

HARTZELL (F. Z.). **A Method of Graphically Illustrating the Distribution of Injury by an Insect Pest.**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 1, February 1918, pp. 32–39, 2 figs.

In studying infestations of insect pests, it is frequently necessary for the entomologist to determine and describe the relations of the insect to its environmental complex. As a means of conveying this information clearly and accurately, graphs are found to be a method of representation far superior to tables or written descriptions. Plans for the preparation of graphs and maps and cardboard models are described in this paper, and an example is given to illustrate the practical application of these methods.

There are many advantages in the use of orthographic projection. The amount of injury and its location throughout the area studied can be clearly shown. The data can be presented with the finest possible degree of accuracy. The charts assist in making proper deductions regarding the relationships between the distribution of the injury and the environmental factors. Data taken accurately for the chart can be used for detailed biometrical analysis. Correlation coefficients and equations will give relationships in a quantitative form and can often be used as supplementary to an orthographic chart. The chart can be made with comparatively little extra study of principles and methods, and, if not too intricate, is readily comprehended. Even an intricate chart presents the conditions throughout every portion of the planting better than tables or any other form of graphical or pictorial representation. A solid model of the conditions

represented is a useful addition to the chart for the purpose of teaching the principles involved or when the amount of detail tends to become confusing.

Webster (R. L.). **Notes on the Strawberry Leaf-Roller** (*Ancylis comptana*, **Fröhl.**).—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 1, February 1918, pp. 42–46.

These notes on the life-history of *Ancylis comptana*, were made in Iowa. Many contradictory statements have been made as to the manner in which this moth hibernates; in central Iowa it is now established that the winter is passed in the larval stage. These larvae after hibernating feed to some extent in early spring, but soon mature and transform to pupae and reach the adult stage in April. The first spring brood emerges in May, a second generation maturing in June, a third in August and sometimes a fourth in September. Eggs are deposited on the under-sides of the leaves and hatch after an incubation period of 3 to 12 days according to the temperature, the average number of eggs per female being 73. The larval period consists of 4 instars and averages 20 days in July and August. The average length of the pupal stage in April and May is 14 to 18 days, and in the summer months about 6 days. A cool summer retards emergence from the pupa, and a hot one accelerates it. Both sexes of the adult moths live about 10 days in insectary cages.

Spraying should be done early in May, before the larvae have folded or rolled the leaves. After the leaves are rolled sprays are largely ineffective. Arsenical spraying should be done before the eggs of *A. comptana* hatch and previous to blossoming, or the poison will destroy hees.

Peterson (A.). **Some Experiments on the Adults and Eggs of the Peach Tree Borer,** *Sanninoidea exitiosa*, **Say, and other Notes.**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 1, February 1918, pp. 46–55, 1 fig.

The majority of the experiments described in this paper were conducted under two large wire-screen cages erected in an orchard in New Jersey that was severely infested with *Aegeria* (*Sanninoidea*) *exitiosa*. Adults emerged most freely about mid-August, always in the early morning, and after pairing, which usually occurred within 1 to 24 hours after emergence, the females began to deposit eggs averaging in number about 314. No adult, either in captivity or in the orchard, was observed to feed at any time, nor could they be induced to do so, although various substances were tried; hence the improbability of devising an attractive poison-bait for the moths themselves. Certain chemical sprays were tried as repellents to prevent oviposition on peach branches; these included scalecide, carbolic, lime-sulphur, nicotine resinate, fish-oil soap, and fly-skat (a creosote compound). The results are given in a table, and, while not very definite, they show a partially repellent effect in the case of scalecide, lime-sulphur, fish-oil soap and fly-skat. These, used on a larger scale, served to reduce oviposition in some instances by 50 per cent. and even more, though no material completely repelled the females. It was observed

during these experiments that eggs were not deposited exclusively on peach-trees, as the cage and floor were also used to some extent.

The eggs hatch after an incubation period of from 9 to 11 days. Eggs deposited by unfertilised females never hatched. When deposited on sprayed branches, the spray never affected hatching of the eggs. Eggs were sprayed experimentally within 5 days of deposition with various common contact insecticides, but while these destroyed a certain number of eggs, no material proved to be an infallible agent in killing them. A table shows the substances used and their effect. It was thought that these chemicals might act as a stomach poison to the larva when eating its way out of the egg, but apparently little or none of the shell is consumed in this process.

These results are largely negative, and the author is of the opinion that some mechanical or chemical barrier that will kill the larva before it enters the tree, or prevent it from entering, will be the solution of the problem of peach-tree borer infestation.

In the discussion following the reading of this paper it was explained that the use of tree protectors is still in the experimental stage. In using tree protectors that have been sealed with asphalt or borene advantageous use has been made of a strong paper clip, which is slipped over the tarred paper where the two margins overlap and helps to hold the protector in position while the openings are sealed. It is hoped to collect further data on these lines during the spring of 1918.

PARROTT (P. J.). **The Apple Ermine Moth.**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 1, February 1918, pp. 55–57.

Hyponomeuta padellus, L., (cherry ermine moth) has previously been recorded on imported cherry seedlings, and an allied species has recently been observed on apples, on which it is the most abundant and persistent of all the insects imported from Europe on apple seedlings. During recent years these moths have greatly increased in numbers, although neither species has been recorded in any other State than New York. Besides occurring in foreign importations, the pest has been discovered in three orchards, obviously originating from eggs on imported apple seedlings, and although other kinds of fruit were present, the infestation was entirely confined to apple trees. The occurrence of the insect on apple, and not on cherry, raises the question as to whether the species concerned is *H. padellus* or *H. malinellus*. The adults of the former species are exceedingly variable in their markings, and unfortunately the identification of the two species seems to rest largely upon the colour distinction of the adults, which are sufficiently differentiated when characteristic examples are selected, but in others tend to merge into each other by imperceptible gradations. Specimens recently bred from apples were sent for identification to Paris to Dr. Paul Marchal, who reported that they agreed well with examples of *H. malinellus*, but expressed a doubt as to whether *H. padellus* and *H. malinellus* are in reality distinct species.

Breeding experiments are needed to settle definitely the status of these two moths, but until these are undertaken it is considered advisable to designate the insects bred from hawthorn and cherry as *H. padellus* and those from apple as *H. malinellus*.

LOVETT (A. L.). **The Calcium Arsenates.**—*Jl. Econ Entom Concord N.H.*, xi, no. 1, February 1918, pp. 57–62.

Owing to War conditions having seriously affected the supply of lead arsenate, it has become necessary to find an efficient and practical substitute as a stomach poison for insects. Calcium arsenate has long been recognised as a cheaper material than lead arsenate, but has been considered unsatisfactory as it causes scorching of the foliage. It could be obtained at one-half the cost of lead arsenate, even before the War. As the cause of scorching is generally the arsenic contained in the spray, and as considerable difficulty was encountered in the same way with lead arsenate when it was first used, it was assumed that a more complete knowledge of the properties of calcium arsenate, its composition and preparation, might lead to some practical method for its substitution for the more expensive lead arsenates.

With the object of studying the properties of the calcium arsenates, two pure calcium salts, acid calcium arsenate, $CaHAsO_4$ and the neutral or basic calcium arsenate, $Ca\ (AsO_4)^2$, were prepared and tested. The former was found to be more soluble and less stable when subjected to unfavourable conditions than was the latter. Either of the pure salts or the commercial salts when in solution with an excess of ordinary quicklime (CaO) or with lime-sulphur gave no unfavourable reaction and judging from a chemical laboratory test should prove safe spray materials. Care should be taken that the lime used is fairly pure CaO and not $CaCO_3$.

In preliminary field spraying experiments, the commercial materials showed decidedly better adhesive properties than the pure materials. Control trees that were sprayed without the addition of either lime or lime-sulphur exhibited decided scorching, but the addition of an excess of CaO in the lime-sulphur and calcium arsenate spray was apparently a sufficient protection. In preparing the solution for field spraying, the lime should be slaked and added to the water in proper proportions in the spray tank and the solution agitated for some 15 minutes before the calcium arsenate is added.

HARTZELL (F. Z.). **The Influence of Molasses on the Adhesiveness of Arsenate of Lead.**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 1, February 1918, pp. 62–66.

During 1910–1916 the author used molasses to render lead arsenate more attractive to *Macrodactylus subspinosus* (rose chafer) and to *Fidia viticida* (grape root-worm) with much success, largely, it is believed, owing to the lack of rain in the period immediately following the application. Certain attempts indicated that the shorter the time between the spraying and the first rain, the less perfect was the control of the insect. Tests of adhesiveness were then made in the laboratory, photographic plates being used as a substitute for the leaf surface. These results are shown in a table. The percentage of material remaining on the plates after sprinkling was found to differ considerably with the different brands of lead. No dry arsenate of lead proved as adhesive as the better adhering paste lead arsenates, though several of the brands of paste lead arsenate had poorer adhesive qualities than the dry lead arsenates tested. The addition of molasses to lead arsenate

lessened its adhesive properties, this decrease in adhesiveness being greater in some brands than in others. Molasses was found also greatly to decrease the adhesiveness of a commercial preparation of Bordeaux mixture and lead arsenate. As cane sugar, used in practically the same amount as is contained in molasses, caused marked lack of adhesiveness in lead arsenate, it is believed that the sugar in the molasses is largely responsible for the decreased power of adhesion.

Working upon these indications it was found possible to secure excellent results with molasses and lead arsenate in the control of *F. viticida* by studying the weather and applying the spray when there was little probability of rain for three or four days, and also by following the first spraying in about a week with an application of Bordeaux mixture and lead arsenate to act as a repellent to invading beetles that might enter the vineyard during the dispersion period.

LOVETT (A. L.). **Spreaders for Arsenate Sprays.**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 1, February 1918, pp. 66–69.

The problem of economy has made necessary a very intensive study of spray materials at Oregon, where the mild climate, excessive moisture conditions in the spring, and the narrow margin of profit, require a very high percentage of perfect fruit if the crop is to produce any return. The investigations of the past three seasons have led to the conclusion that lead arsenates have hitherto been used in a more concentrated form than is necessary [see this *Review*, Ser. A, iii, p. 759 and v, p. 477]. Laboratory experiments indicate that approximately as great efficiency is obtained with acid lead arsenate at a dilution of 1:400 as at 2:50. Growers however prefer the additional expense of using 3½ lb. to 50 gallons as a protection against codling moth (*Cydia pomonella*) in the July and August applications, but it is believed that if a satisfactory spreader can be developed it will be possible to acquire very effective control of this pest with a diluted spray composed of 1 lb. arsenate to 100 gals. solution. By an efficient spreader is meant some material that allows the droplets to spread out and join one another as they dry so that the arsenate remains as an even, regular, inconspicuous covering affording perfect and equal protection for every surface.

The surface tension and specific gravity are probably important factors in determining the value of a spreader, but the correlation of each to the other has not been determined and does not appear to be in a direct proportion. The ability of a liquid to hold arsenate in suspension does, however, appear to be a very fair indication of its utility as a spreader. The materials tested were sage tea, glue, glycerine, gelatine, sugar, honey, gum tragacanth, fish-oil soap, casein-lime and resin soap. The results of these suspension tests are shown in a table. Sugar precipitated the arsenate, while gum tragacanth did not go into solution. A test of the solutions was then made on bean foliage. The two materials that produced the least scorching were sage tea (5 : 1000) and the casein-lime mixture (5 : 1000), and these also approximated to the ideal qualifications for a spreader. Tested on strawberry foliage they gave equally satisfactory results.

Sage tea is obtained by steeping 1 lb. of chopped leaves and stems of the common prairie sage bush of Oregon (*Artemisia tridentata*) in 1 U.S. gal. water. The sage is added to the boiling water and the vessel covered and allowed to stand for 12 hours or more. The liquid then drawn off is an oily emulsion-like fluid. The casein-lime mixture is obtained by adding to 3½ grams of quicklime 1½ grams of powdered casein. This is ground in a mortar to a homogeneous mass, of which 4 to 8 oz. is required to give the spreading qualities desired to 100 U.S. gals. of spray.

MOORE (W.) & GRAHAM (S. A.). **A Study of the Toxicity of Kerosene.**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 1, February 1918, pp. 70–75.

While kerosene and its emulsions have been in general use as insecticides for many years, the results obtained in using this material have been so variable that within recent years it has largely been abandoned in the United States. In the investigations recorded in this paper it was found that kerosene varies greatly in its physical characteristics and its chemical composition, even when coming from the same oil-field. For these experiments five different oils were obtained and each was fractionally distilled into four parts. The results of the various tests are tabulated. Low boiling point fractions of kerosene proved in general more toxic to plants than high boiling point fractions when used pure. Injury by fractions with low boiling points can however be largely prevented if they are applied in the form of an emulsion, the emulsion holding the oil away from the plant until it has evaporated. Emulsification of high boiling point fractions does not give this protection since the oil remains on the leaf after the emulsion is destroyed. Low boiling point fractions are more toxic to insects in the form of vapour than high boiling point ones, owing to the slight volatility of the higher fractions. High boiling point compounds are more toxic than low boiling point compounds when used as contact insecticides in the form of an emulsion. Certain types of kerosene can be used pure upon certain plants under favourable climatic conditions without injury, and while the use of kerosene is always uncertain, certain forms of considerable value as insecticides and of very slight toxicity to plants can be manufactured. They should be prepared for this particular purpose and to meet an insecticide test rather than a flash test.

HOWARD (N. F.). U.S. Bur. Entom. **Insecticide Tests with *Diabrotica vittata*.**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 1, February 1918, pp. 75–79.

Experiments in the control of *Diabrotica vittata* (striped cucumber beetle) were made on a large scale in 1916 at Wisconsin, with a view to eliminating the mosaic disease, in the dissemination of which this insect is supposed to be an important factor. Bordeaux mixture (2 : 4 : 50) with lead arsenate paste (4 : 50) was applied to all cucurbits in an isolated area where the beetles were extremely abundant, and the treatment continued every 7 to 10 days during the first half of the season. It was soon apparent that the control of the beetle was far

from perfect, while the mosaic disease remained unchecked. Preliminary tests of the efficiency of the spray used showed only about 26 per cent. mortality of the beetles.

A series of tests with various insecticides was then conducted in large cages, the results being shown in a table. The average of two season's results showed for zinc arsenite an efficiency of 24 per cent.; lead arsenate, either sweetened or not, 17 per cent.; Paris green, 16 per cent.; zinc arsenate, 14 per cent.; Bordeaux lead arsenate, 14 per cent.; lead arsenate dust, 9 per cent.; cobalt arsenate, 4 per cent.; calcium arsenate, 1 per cent.; arsenic bisulphide (Realgar), 0 per cent. Zinc arsenate is too unstable, in its present commercial form, to be of importance. Arsenic bisulphide is too heavy to stay in suspension and does not spread well.

It is evident from these results that *Diabrotica vittata* is difficult to poison. In cases where Bordeaux mixture is of value in controlling plant diseases it may be used to advantage with lead arsenate or zinc arsenate. Under the conditions prevailing in the cucumber-growing sections of the north central States, its value as a control of the insect does not warrant the expense of application.

WILSON (H. F.) & GENTNER (L. G.). **The Imported Cabbage Worm in Wisconsin.**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 1, February 1918, pp. 79–81, 2 plates.

The investigations recorded in this paper were made with the object of convincing Wisconsin growers that cabbages sprayed with arsenicals for the control of the imported cabbage worm [*Pieris rapae*] are not rendered dangerous for use as food.

Life-history studies of this butterfly during two seasons have shown that there are three distinct generations in a year and sometimes a partial fourth. There is usually some overlapping of the generations, especially toward the end of the season. Adults emerge chiefly during the first two weeks of May, from the pupae that have hibernated; those of the first generation appear in the first half of July; those of the second generation during the first half of August. In the southern half of the State both early and late cabbages are grown, while in the northern sections generally only the late variety is cultivated. The early cabbage generally matures without much injury, but the late variety is often seriously attacked.

The tests showed that while Paris green gives efficient control its cost is too high for economical use. Lead arsenate and calcium arsenate at the rate of 1 lb. powder or 2 lb. paste to 50 U.S. gals., with the addition of 1 lb. or more of common laundry soap, give efficient control and are the most economical to use. Zinc arsenite failed to control the caterpillars, contrary to expectations, and further experiments will be made. Tobacco dust and lime apparently had no effect upon the insects.

No trace of arsenic was found to be present on heads prepared for cooking, even when these had been sprayed as late as a week before picking. The outer leaves may however carry enough arsenic to poison stock and it is therefore dangerous to use them for feeding.

HOWARD (N. F.). U.S. Bur. Entom. **Poisoned Bait for the Onion Maggot.**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 1, February 1918, pp. 82–87, 2 plates.

This paper summarises the work carried on in Wisconsin during 1915–16 with poisoned bait for the control of the onion maggot, *Hylemyia antiqua*, Meig. The bait used consisted of about $\frac{1}{8}$ oz. of sodium arsenite dissolved in boiling water, $\frac{1}{2}$ U.S. pint of molasses and 1 U.S. gal. of water. The addition of sliced lemon to this mixture was found to render it far more attractive. Experiments in the laboratory showed that at this strength sodium arsenite is fatal to *H. antiqua*, to the cabbage fly (*Phorbia brassicae*) and to *Phorbia* (*Pegomyia*) *fusciceps*. The result of two seasons' work in the field, however, has shown very little success, the poor results being ascribed to adverse climatic conditions, which are apparently normal in this and other onion-growing districts, where frequent rain is apt to nullify the action of the poison.

In the discussion following the reading of this paper it was remarked that trials on the same plan had given very good results in New Jersey, in spite of a rainy season, the rain, however, not being continuous. In that State it was found that where the treatment was applied there was no trouble with the onion maggot, otherwise the pest gave trouble. In Ohio, during two seasons' trials, the cost of the applications far exceeded the value of the crops. Even so, it is intended to continue this method, which affords some promise of ultimate success, and it is not proposed to discontinue the work just at the time when it is much needed, as has been done so frequently in similar cases.

KING (J. L.). **Notes on the Biology of the Angoumois Grain Moth,** *Sitotroga cerealella*, **Oliv.**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 1, February 1918, pp. 87–93, 2 figs.

Sitotroga cerealella, Oliv. (Angoumois grain moth) is such a scourge in the south-eastern wheat-producing counties of the United States that as much as 75 to 90 per cent. of the crop is lost in some districts, the aggregate annual loss for the whole region being estimated at over £200,000. Most of this loss occurs after the harvest, and is due to the common practice of storing unthreshed grain in the barns until some convenient time for threshing, but the investigations recorded in this paper show that the insect does not confine its depredations to stored grain, as hitherto believed, but may begin its attack on the developing grain in the field.

Larvae may be found hibernating in various stages of development in scattered grain in supposed empty barns, and in bags of mill-screening, etc. These in early spring complete their development and pupate towards the end of May within the wheat grains. The average length of the pupal stage is 13 days. Adults emerge chiefly in the mornings, flying, pairing and ovipositing in the dusk of early evening and morning. It is these moths developing from the hibernating larvae and forming the first generation that cause the initial larval damage to the season's wheat crop. This generation seems to reach its maximum between 5th and 15th June. The period of flight of the moths and oviposition is coincident with the heading of the wheat in the fields. Moths in

confinement readily deposited their eggs on the heads of green wheat, generally under the protection of the glumes, the average number among four moths observed being 92. In the warm June days the egg stage lasts from 7 to 9 days.

Wheat in all stages of development is subject to attacks of the larvae, though under natural conditions few larvae appear early enough to attack the heads before pollination. The larvae upon hatching enter the grain by gnawing through the pericarp and, as they mature, the entire contents of the grain are eaten out. Larvae entering the grain in mid-June require 41 to 49 days before emergence of the adults; those entering green and milky wheat require 40 to 44 days to complete their development. A diagram shows the generations of this moth and the times of their occurrence. Those appearing at harvest time constitute the second generation, the maximum number being present in early August. When the harvest is gathered late, a small number of moths emerge in the field and give rise to a third generation in September, which is the last to appear in the open. Moths of the second generation that emerge in the barns carry on their depredations through 6 and even 7 generations, so long as the grain is unthreshed and there is no severe weather. The practice of leaving the grain lying in the barn and threshing it only as the straw is needed is conducive to most rapid development of the moths.

The first essential in control of this pest is to thresh the wheat as soon after the harvest as possible. Grain stored in tight granaries or in good sacks is less liable to repeated attacks and can easily be treated with carbon bisulphide. Thorough barn sanitation and the elimination or utilisation of all scattered wheat are of extreme importance in checking the pest. Floors and beams should be swept. Poultry are useful in clearing the grain from crevices in the floor. Infested screenings should be ground or immediately used as food for stock, and all grain should be threshed in future in the open to avoid re-infestation of the barn. The author is of opinion that if co-operative early threshing and thorough barn sanitation are practised the use of carbon bisulphide will be found unnecessary.

In the discussion following the reading of this paper, *S. cerealella* was reported for the first time in Nebraska during the summer of 1917; while in Kansas the pest is largely controlled in the wheat by early threshing, but is still a serious pest in the chaff, and it is found necessary to fumigate the seed before sowing. Investigations are still being carried on to determine whether the moth can develop in the field throughout the year without passing into the granaries at all, and also whether the insects can be carried into the soil in infested grain.

How Can the Entomologist Assist in Increasing Food Production?—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 1, February 1918, pp. 106–118.

In opening the discussion on this subject, Mr. G. A. Dean stated that in Kansas insects cause an annual loss of not less than £8,000,000, fully £5,000,000 of which could be eliminated if the practical methods of control that have been found effective were put into operation. He described a scheme for effective work in insect control, emphasising the necessity for adequate propaganda, for planning and directing

field work, and for organisation and co-operation of all interested persons. Mr. M. J. Swenk described the problem as relating to Nebraska, and suggested that a beginning should be made by each entomologist analysing the situation as it occurs in his own State and determining the pests that cause the most important losses in that State. Mr. H. A. Gossard gave an interesting account of the conditions and work accomplished in the past season in Ohio. Mr. Herbert Osborn remarked that the subject covered both production and preservation of food. He considered that the service of the economic entomologist should be directed on certain distinct lines. Investigations bearing directly and urgently upon measures of protection and preservation of crops should be pushed forward. Extensive surveys should be made in order to determine as accurately as possible the conditions of insect life and the most menacing species for the immediate future, and to secure data upon which recommendations to cultivators can be based. The distribution of information through various channels, and the instruction and training of entomological workers are other important points. Mr. E. P. Felt called attention to the importance of preventing apparently minor losses throughout the country, such as depredations of garden insects in small holdings, and the necessity for the care of stored grain, prompt clearing away of refuse, rotation of crops and clean cultivation. The entomologist should be in a position to restrict or modify spraying schedules, and should not overstep practical considerations or advise treatments that are not justified financially. Mr. J. J. Davis touched upon the value of the co-operation of local agents, and the importance of their being in communication with the entomological service.

The Section of Horticultural Inspection.—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 1, February 1918, pp. 118–120.

A report submitted by a special committee on plant importation, composed of Messrs. J. Headlee, G. A. Dean and E. D. Ball, states that the importation of all nursery stock as designated in the Federal Plant Quarantine Act of 20th August 1912, should be prohibited except as brought in under carefully guarded quarantine regulations of the U.S. Department of Agriculture; that an absolute embargo should be placed at once on nursery stock coming in with soil about the roots; that the prohibition against all other kinds should be issued with due regard to the time necessary to enable the businesses affected to adjust themselves to the change, after which absolute prohibition should obtain. This resolution was unanimously adopted by the Association.

Weiss (H. B.). **The Control of Imported Pests recently found in New Jersey.**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 1, February 1918, pp. 122–125.

During normal years nearly one-fifth of the nursery stock imported into the United States is consigned to New Jersey, which is consequently in greater danger from an influx of foreign insects than most other States, in spite of an excellent system of inspection. It is therefore necessary to examine continually the nurseries and places to which the stock is consigned.

Among the more important foreign species found during recent years are *Gryllotalpa gryllotalpa*, L. (European mole cricket) in a rose garden. The infested area has been examined for the past two years and the nests destroyed during June and July, and by this means the pest has been kept down to comparatively harmless numbers. The presence of *Monarthropalpus buxi*, Lab. (boxwood leaf-miner) has necessitated the destruction of many plants in nurseries. *Rhyacionia* (*Evetria*) *buoliana*, Schiff. (European pine-shoot moth) caused infested shoots to be cut off and destroyed until the infestations were eradicated. *Gracilaria zachrysa*, Meyr. (azalea leaf-miner) is generally confined to azaleas in greenhouses. Spraying with lead arsenate and fumigation with tobacco extract has afforded fair control. *Plagiodera versicolor*, Laich., feeds on the foliage of poplar and willow and is readily controlled by arsenicals. *Popillia japonica*, Newm., which is a pest of grape, beans, peas and peanuts in Japan, has been found on roses, ampelopsis, grape, elder, crataegus and button bush, being probably imported in the soil round iris roots from Japan. The sawfly, *Diprion simile*, Hart., is controlled by lead arsenate sprays, and appears to have an efficient parasite in *Monodontomerus dentipes*, Boh. *Trioza alacris*, Flor (laurel psyllid) has been introduced from Belgium. The nymphs curl the leaves and spoil the trees for ornamental purposes. Fumigation with tobacco smoke should be carried out during the winter while the trees are in storing sheds and the adults are hibernating. *Stephanitis pyrioides*, Scott, a lace-bug injurious to evergreen azaleas, became widely distributed in New Jersey before its presence was discovered. It is being sprayed with whale-oil soap after the eggs have hatched.

The weevils, *Acythopeus orchivora*, Blackb., *Cholus cattleyae*, Champ., *Cholus forbesi*, Pasc., *Diorymellus laevimargo*, Champ., and two undescribed species have all become established in orchid-houses. These are natives of tropical America and very little is known of their life-histories. Hand-picking or destruction of badly infested parts is practised. *Magdalis barbicornis*, Latr., is established in New Jersey, New York and Massachusetts. It is known as the apple stem piercer and is likely to attack apple, quince and medlar trees.

SASSCER (E. R.). **Important Foreign Insect Pests collected on Imported Nursery Stock in 1917.**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 1, February 1918, pp. 125–129.

The pests intercepted include: Egg-masses of *Lymantria* (*Porthetria*) *dispar* (gipsy moth) from Belgium and France; a nest of *Nygmia phaeorrhoea* (*Euproctis chrysorrhoea*) (brown-tail moth) on apple from France; larvae of *Arctornis chrysorrhoea*, L. (*Porthesia similis*, Fuessl.) (gold-tail moth) on rhododendron, laburnum and roses from Holland. As this latter insect is a general defoliator of forest trees in Europe, it is of the greatest importance to prevent its establishment in the States. Nests of the butterfly, *Aporia crataegi*, L., were found on deciduous fruit-tree seedlings from France. Larvae of *Acronycta rumicis*, L., have been collected on rose stock and *Cornus* from France and azaleas from Belgium; *Trioza alacris*, Flor (bay psyllid) was reported on Belgian bays, and *Psylla buxi*, L. (box psyllid) and *Monarthropalpus buxi*, Lab. (box leaf-miner) on boxwood from Holland;

egg-masses of *Orgyia* (*Notolophus*) *antiqua*, L. (vapourer moth) and pupae of *Apatela auricoma*, F. (dagger moth) have been frequently taken on stock from France and Holland. Cocoons, apparently of the sawfly, *Emphytus cinctus*, L., have been collected on roses from England. The weevil, *Anthonomus bisignatus*, Roel., was found infesting seed of *Prunus sargenti* from Japan, and the whole consignment was fumigated with carbon bisulphide (3 lb. per 1,000 cub. ft. for 24 hours). *Parlatoria chinensis*, Marlatt (chaff scale), was taken on *Pyrus sinensis* and *P. ussuriensis* from China, where it is apparently a serious pest, injuring crab-apple, *Hibiscus*, *Zizyphus* and *Thuja orientalis*. Larvae of *Agrilus* sp. were taken in galls on chestnut trees from Japan; *Gracilaria zachrysa*, Meyr. (azalea leaf-miner) was found infesting azaleas from Belgium and Holland.

On tropical plants the following were intercepted: *Sternochetus mangiferae*, F. (mango weevil), in mango seed from India, and *Coccus mangiferae*, Green, on the same plant from Cuba. *Stenoma* sp. and an apparently undescribed species of *Conotrachelus* were found infesting avocado seed from Guatemala. Avocado seeds from the same country were also infested with the Coccids, *Aspidiotus subsimilis*, Ckll., *Aspidiotus* sp. near *A. cocotiphagus*, *Chrysomphalus scutiformis*, Ckll., *C. personatus*, Comst., *Pseudoparlatoria ostreata*, Ckll., *Lepidosaphes mimosarum*, Ckll., *Diaspis* sp., *Ceroplastes* sp., *Solenococcus* sp., *Lecanium* sp. and *Coccus* sp.

Lepidosaphes ficus, Sign. (fig scale) was intercepted on fig trees from Spain. *Toxotrypana curvicauda*, Gerst. (papaya fruit-fly) was taken in papaya fruit from Cuba. Among the scale-insects intercepted were:—*Phenacaspis eugeniae*, Mask, on coconuts from Ceylon. *Antonina crawi*, Ckll., on bamboo from Japan and *Pseudococcus sacchari* (sugar-cane mealy bug) on sugar-cane from Jamaica, Trinidad and Hawaii.

Orchids are responsible for the introduction of many pests, at least 64 species having been collected on plants from South America. Twenty of these species were ants, the majority of them now being established. *Pheidole anastasii*, Emery, collected on *Phormium tenax* from the Azores, is troublesome in greenhouses; *Prenolepis longicornis*, Latr., known as the crazy ant, is a household pest as far north as Boston. A species of *Iridomyrmex* was found in a shipment of *Theobroma cacao* from Java. *Parallelodiplosis cattleyae*, Felt (cattleya midge) was collected on orchids from Central and South America, as well as 15 species of scale-insects from various countries. All orchids arriving from countries without a recognised inspection service are now being fumigated at the port of entry.

A list of countries is given with the number of species of insects imported from each.

PRIMM (J. K.). **The European Poplar Canker in the Vicinity of Philadelphia, Pennsylvania.**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 1, February 1918, pp. 129–133.

In the course of investigations regarding the European poplar canker (*Dothichiza populnea*) in Pennsylvania nurseries, it was observed that in a block of balsam poplars that were seriously infested with *Cryptorrhynchus lapathi* (poplar weevil) all the trees were also badly

cankered, while some Lombardy poplars in an adjacent block not attacked by this weevil were free from the disease. Incipient cankers were found also in the wounds made by the egg-punctures of the buffalo tree-hopper (*Ceresa bubalus*).

HAYES (W. P.). **Studies on the Life-history of Two Kansas Scarabæidæ (Coleop.).**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 1, February 1918, p. 136.

Cyclocephala villosa, Burm., has a life-cycle occupying one year and is one of the many injurious white-grubs belonging to this genus. Adults are attracted to lights and may be found in June, July and early August. Eggs are laid in the soil and hatch in from 9 to 25 days. The winter is passed in the larval stage, which averages 347 days. The pupal stage varies from 8 to 24 days.

Anomala binotata, Gyll., is injurious in the adult stage to fruit-producing plants, and the grubs are minor pests of maize, wheat, and oats. Winter is passed in the adult stage. Eggs are laid in the spring and soon hatch, the larvae requiring some 83 days for their development. The pupal stage lasts on an average 16 days. Transformation to the adult stage takes place in the autumn, the adults remaining in the pupal cells until the following spring, thus completing a one-year life-cycle.

LATHROP (F. H.). **Notes on Three Species of Apple Leaf-hoppers.**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 1, February 1918, pp. 144–148, 1 fig.

The apple leaf-hoppers, *Empoasca mali*, Le B., *E. unicolor*, Gill., and *Empoa rosae*, L., are very similar in appearance. Their distinguishing characteristics are dealt with in this paper.

Empoa rosae hibernates in the egg-stage, most of the eggs being deposited in the bark of the rose, or sometimes on apple. The nymphs feed on the under-side of the leaves. Adults begin to appear during the second week of June and migrate to apple, where they are found until late in July. Nymphs of the second generation, hatching from eggs deposited on apple, appear in mid-July and become adults in early August. In early October the adults return to the rose, on which the winter eggs are deposited.

Empoasca mali hibernates in the adult form, the nymphs of the first generation appearing during the last ten days in June. By mid-July these have become adults, and at the end of the month second generation nymphs appear, many of these maturing in September and remaining on the trees in all stages until frost clears off the last nymphs. These late nymphs may be a third generation from the earliest of the second generation adults. This species feeds almost exclusively on the tender terminal growth, causing severe curling of the leaves.

Empoasca unicolor hibernates in the egg-stage, nymphs occurring during the last week in May. Adults have not been observed before early July. There is but one generation in a year, the adults ovipositing in autumn in the bark of apple, for preference on young trees.

Experiments to determine the possibility of the transmission of fire-blight [*Bacillus amylovorus*] by these species proved negative.

HODGKISS (H. E.). *Eriophyes ramosus*, sp. n.—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 1, February 1918, p. 149.

An infestation of *Juniperus pachyphloea* by Eriophyid mites is recorded in Arizona. Attacked twigs bore several large, more or less deformed, infertile fruits, in some of which the mites were so abundant as to fill completely the hollowed-out fruits. A similar injury has been recorded on *Juniperus communis*, L., in Europe, where it is said to be caused by *Eriophyes quadrisetus typicus*, Thom. The American form differs in several respects from that species, and is described in this paper as *Eriophyes ramosus*, sp. n.

LOVETT (A. L.). **Nicotine Sulphate an Effective Ovicide for Codling Moth Eggs.**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 1, February 1918, pp. 149–150.

Experiments to determine the efficacy of various strengths of nicotine sulphate as an ovicide for eggs of the codling moth [*Cydia pomonella*] have confirmed the utility of this spray. Black leaf 40 (1 : 1,200) with fish-oil soap 4 lb. to 100 U.S. gals. water, proved to be a perfect mixture, 100 per cent. of the eggs being killed.

BEZZI (M.). **Notes on the Ethiopian Fruit-flies of the Family Trypaneidae, other than *Dacus* (s.l.), with Descriptions of New Genera and Species (Dipt.).—I.**—*Bull. Entom. Research, London*, viii, no. 3–4, February 1918, pp. 215–251, 1 plate, 3 figs.

This paper gives a summary of the classification of the Ethiopian species of TRYPETIDAE, with keys to the sub-families.

A list of the Ethiopian Trypetids, published by the author in 1908, enumerated about 70 species (excluding *Dacus*), this number being now increased to about 110 by recent additions. Since in the Oriental and Australian regions about 170 species (without *Dacus*) are known, and in the Neotropical, including Mexico and Central America (where *Dacus* does not occur) about 250, it is certain that many undescribed Ethiopian species actually exist.

The new genera and species described include *Conradtina suspensa*, sp. n., from the Congo; *Carpophthoromyia pseudotritea*, sp. n., from West Africa, previously recorded as *C. tritea*, Walk., bred from fruits of *Pyrenacantha vogeliana* in West Africa; *C. superba*, sp.n., from Nyasaland; *Leucotaeniella*, gen. nov., including *L. trispila*, sp. n., from Nyasaland, and *L. pentaspila*, sp. n., from the Anglo-Egyptian Sudan; *Chelyophora magniceps*, sp. n., from the Sudan; *Pterandrus volucris*, gen. et sp. n., from East Africa; *Pardalaspis quinaria*, gen. et sp. n., bred from apricot in Rhodesia; *Trirhithrum*, gen. nov., including *T. gagatinum*, sp. n., from the Gold Coast; *T. occipitale*, sp. n., from Nyasaland; *T. nigerrimum*, var. *leucopsis*, var. nov., from Nyasaland; *T. nigerrimum*, var. *coffeae*, var. nov., bred from coffee berries in the Gold Coast; *Baryglossa*, gen. nov., including *B. histrio*, sp. n., from the Belgian Congo; and *Ptiloniola neavei*, sp. n., from Nyasaland.

MARSHALL (G. A. K.). **A New Weevil Pest of Sweet Potatoes in Jamaica.**—*Bull. Entom. Research, London*, viii, no. 3-4, February 1918, pp. 269-272, 1 fig.

A new weevil, *Palaeopus costicollis*, sp. n., recently received from Jamaica, is here described. The damage done to the tubers of sweet potato crops by this insect is serious, and quite similar in nature to that caused by the common West Indian pest, *Euscepes batatae*, Waterh. As the two insects would almost certainly be confused by untrained observers, it is very probable that some of the injury attributed to *E. batatae* has really been due to this new pest.

Two other species of this genus found by the author in the British Museum collection, viz.:—*P. subgranulatus*, sp. n., from St. Vincent, and *P. grenadensis*, sp. n., from Grenada, are also dealt with.

THEOBALD (F. V.). **African Aphididae.—Part III.**—*Bull. Entom. Research, London*, viii, no. 3-4, February 1918, pp. 273-294, 15 figs.

Twelve new species of African Aphids and four previously described ones are dealt with in this paper, which is a continuation of one already noticed [see this *Review*, Ser. A, iii, p. 748].

The new species are:—*Macrosiphum dahliafolii*, sp. n., from Uganda, on dahlias, the only other known species feeding on dahlias being *Aphis rumicis* (*A. dahliae*, Westw.); *Aphis durantae*, sp. n., a very small species from Egypt, living on the main and secondary veins on the upper surface of the leaves of duranta; *A. zizyphi*, sp. n., from Egypt on *Zizyphus spina-christi*, swarming on the ends of the young shoots; *A. ficus*, sp. n., from Egypt and Uganda on sycomore fig (*Ficus sycomorus*) especially on leaves attacked by Psyllids; *A. tamaricis*, sp. n., from Egypt on *Tamarix* sp.; *A. bauhiniae*, sp. n., from Egypt on *Bauhinia*; *A. buddleiae*, sp. n., from Cairo, where it occurs in great numbers on the leaves of *Buddleia madagascariensis*; *A. mathiolae*, sp. n., and *A. mathiolellae*, sp. n., from Egypt on ornamental stocks; *A. pruniella*, sp. n., from British East Africa, on plum; *Hyalopterus insignis*, sp. n., from Egypt, in colonies on the under-sides of the leaves of reed grass or buffalo grass; and *Myzus pterisoides*, sp. n., from Uganda, on ferns.

The previously described species are:—*Aphis pomonella*, Theo., from British East Africa, on apple, this species being closely related to *A. pomi*; *A. pheidole*, Theo., found associated with ants (*Pheidole* sp.) in N.W. Rhodesia; *A. acetosae*, Koch, from Egypt, England and Germany on *Rumex* spp. and *Papaver* spp.; and *Siphocoryne* (*A.*) *pseudobrassicae*, Davis, which occurs in the United States on radish, turnip, rape, kale, mustard, etc., and is now recorded from Cape Colony.

New localities and food-plants are recorded for the following:—*Rhopalosiphum dianthi*, Schrank, from Egypt, in great numbers on cabbages in company with *A. brassicae*, L.; *Hyalopterus pruni*, F., (*arundinis*, F., *phragmiticola*, Oest.), previously reported from Cairo on *Prunus* spp. and various rushes (*Arundo*), now taken at Gizeh on apricot in January and on reed grass in February, this grass being the only alternative food-plant to the peach, apricot and plum. The insect appears in large colonies on the under-side of the leaves of the

apricot, causing little damage, at most a slight turning down of the margin, but the usual severe attacks during the spring months check the growth of young trees. The effect of this Aphid on peach is more marked, the foliage suffering to a greater degree. .Though rare in England, its presence has been recorded from Suffolk on apricot.

SAMPSON (Lt.-Col. W.). **A new Scolytid injurious to dried Sweet Potatoes in Jamaica.**—*Bull. Entom. Research, London,* viii, no. 3–4, February 1918, p. 295.

Hypothenemus ritchiei, sp. n., is described in this paper, the beetle causing serious damage to dried sweet potato chips.

GIBSON (A.). **The Alfalfa Looper, *Autographa californica*, Speyer.**—*Agric. Gaz. Canada, Ottawa,* v, no. 2, February 1918, pp. 132–136, 2 figs.

The alfalfa looper, *Phytometra (Autographa) californica*, is a destructive insect pest of farm and market-garden crops. It is liable to appear suddenly in countless numbers and is widely distributed throughout western North America, where the last serious outbreak occurred in 1914. Accounts of this, together with details of its life-history and methods for its control have already appeared [see this *Review*, Ser. A, iii, pp. 269, 457].

Its natural enemies are evidently widespread, the insect being heavily parasitised by the Tachinids, *Plagia americana*, Van de Wulp, *Exorista futilis*, O.S., and *Phorocera saundersi*, Will.; and by the Hymenoptera, *Microplitis alaskensis*, Ashm., *Sargaritis websteri*, Vier., *Rhogas autographae*, Vier., *Microplitis* sp., *Ameloctonus* sp., and *Apanteles hyslopi*, Vier. In addition to these, birds have been observed to feed readily on the caterpillars, which are also attacked by a bacterial disease.

Work connected with Insect and Fungoid Pests and their Control.—*Rept. Agric. Dept. Antigua, 1916–17*; *Barbados*, 1918, pp. 16–17.

Damage to sugar-cane roots by the grub of the brown hard-back beetle (*Lachnosterna* sp.) was less than usual during 1916–17, owing to the good rainfall, which enabled the plants rapidly to form adventitious roots. A flight of several thousands of these beetles was observed, the irregular infestations on certain estates being probably due to this cause.

Several severe attacks of the cotton caterpillar, *Alabama argillacea*, were experienced, and the bollworm, *Heliothis obsoleta* (*armigera*), and cotton stainers (*Dysdercus* sp.) were fairly common during the early and latter parts of the season respectively. Black scale (*Saissetia nigra*) and white scale (*Hemichionaspis minor*) were common on old cotton towards the end of the season, without however damaging the crop.

On one estate, 70,000 adults of the weevil, *Exophthalmus esuriens*, attacking limes were captured and destroyed during the year. The fact that the number was 200,000 for the same estate the previous year seems to prove the efficacy of this method of control.

Sweet potatoes reared from cuttings obtained from an area free from the beetle, *Euscepes* (*Cryptorrhynchus*) *batatae*, showed only slight infestation, which was not the case with those on small holdings where these precautions had not been taken. Efforts are being made by the Agricultural Department to provide non-infested cuttings in the hope of eradicating the pest in the course of a few years. Several minor outbreaks of the caterpillar, *Protoparce cingulata*, were experienced.

Grubs of *Lachnosterna* sp. attacked the onion and maize crops, the corn ear worm (*Heliothis obsoleta*) being also invariably present on the latter.

DE (M. N.). **Second Report on the Experiments carried out at Pusa to improve the Mulberry Silk Industry, compiled under the Direction of the Imperial Entomologist.**—*Agric. Research Institute, Pusa*; *Calcutta*, Bull. no. 74, 1917, 27 pp., 12 tables. [Received 20th March 1918.]

Multivoltine hybrid races of silk-worms have been successfully established. The yield of silk from these is better than that of the pure multivoltine races generally reared in Bengal, Assam and Mysore. It has been found that all races yield more silk if fed with suitable tree mulberry leaves than when fed with bush leaves, hence tree mulberries should be introduced into all localities in addition to bush plants.

Of all the indigenous races, the Mysore race is the best as regards the yield of silk. The Nistari race should be reared in April or May, the Mysore and hybrid races from July to October, and univoltine races from October to March.

Of all the univoltine races, the Chinese and Japanese ones thrive best in a climate like that of Pusa, but their yield of silk is inferior to those of France and Italy.

Univoltine eggs should be hibernated for about 4 or 5 months at about 35° to 45° F. Though the duration of cold storage can be shortened by the action of intense cold, this and a fluctuation of temperature in the hibernating chamber render the hatching of the eggs unsatisfactory.

As regards the silk-worm diseases flacherie and pebrine, experiments have proved that eggs laid by moths attacked by flacherie can be used for industrial purposes, but that a pebrinised laying will yield good crops and healthy layings only if the worms are carefully attended to, and if the temperature and moisture-content in the air are suitable for the healthy growth of the worms. On the other hand, bad crops and pebrinised layings result from a healthy laying if the temperature and moisture-content are high, and if the worms are not properly looked after. Pebrine is more prevalent in May to October than from September to April, univoltine races being more susceptible to it than multivoltine ones in a climate like that of Pusa.

An improvement in the cocoons of univoltine races by immersing the eggs in dilute hydrochloric acid having been reported from Japan, the eggs of a multivoltine race were experimentally treated on these lines, but with negative results.

The best food-plant for both univoltine and multivoltine races has been proved to be *Morus alba* var. *japonica*, and *M. alba* var. *philippinensis*, there being practically no difference between the male and female plants.

FLEMYNG (W. W.). *Sphinx convolvuli* **attacked by Larvae of Dipteron.**—*Irish Naturalist, Dublin*, xxvii, no. 1, January 1918, p. 13.

An adult example of *Herse* (*Sphinx*) *convolvuli* captured in a garden in Dublin was found, soon after capture, to be surrounded by a number of minute pupae, from which 76 parasitic flies emerged. Mr. J. N. Halbert appends the information that the parasite concerned was *Phora rufipes*, Meig.

HAVILAND (M. D.). **A New Species of** *Myzus* **from the Thistle.**—*Entomologist, London*, li, no. 658, March 1918, pp. 49–50, 1 fig.

Myzus carthusianus, sp. n., here described, was found among a number of examples of *Pemphigus lactucarius* taken on thistle at Godalming in 1916. This species somewhat resembles *M. ribis*, but is of much smaller size and possesses longer cornicles.

QUAINTANCE (A. L.) & BAKER (A. C.). **Aphids injurious to Orchard Fruits, Currant, Gooseberry and Grape.**—*U. S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 804, April 1917, 42 pp., 30 figs. [Received 1st March 1918.]

This bulletin deals with the Aphids that attack the principal orchard and bush fruits.

Those infesting the apple are *A. malifoliae*, Fitch (rosy aphis); *A. pomi*, De G. (green apple aphis), the result of infestation by which is often confused with that of *Empoasca mali*, Le B. (apple leaf-hopper), which distorts the leaves in a similar manner; *A. avenae*, F. (oat aphis); *A. bakeri*, Cow. (clover aphis); *Eriosoma lanigerum*, Hausm. (woolly apple aphis), the control of which on the limbs and branches is effected by the usual contact sprays, but on the roots requires different methods not considered in this bulletin. Minor apple pests are *Macrosiphum solanifoliae*, Ashm. (potato aphis); *A. rumicis*, L. (dock aphis); *A. medicaginis*, Koch (bur-clover aphis); *Hyadaphis xylostei*, Schrank (wild-carrot aphis); *A. crataegifoliae*, Fitch (thorn-leaf aphis), also called the long-beaked clover aphis, which is usually found on hawthorn trees, but is not uncommon upon quince leaves, which however it does not curl to the same extent as it does hawthorn leaves.

The most common species on the pear are *A. pomi*, *A. avenae* and *A. bakeri*, though *Prociphilus corrugatus*, Sirrine (woolly thorn aphis) is common in some localities, occurring also on thorn, quince and Juneberry. Two Aphids attacking the roots of pear-trees are *Eriosoma pyricola*, B. & D. (woolly pear aphis) and *Prociphilus pyri*, Fitch.

The plum is attacked by three or four species of Aphids, two of which are very injurious in some seasons. These are *A. setariae*, Thos. (rusty plum aphis), injuring Japanese and native plums, and *Hyalopterus arundinis*, F. (mealy plum aphis), on the European type of plums.

Other species are *A. cardui*, L. (long-beaked thistle aphis); *Rhopalosiphum* (*Siphocoryne*) *nymphaeae*, L. (water-lily aphis); and *Phorodon humuli*, Schrank (hop aphis).

Cherry Aphids are *Myzus cerasi*, F. (black cherry aphis) and *A. cerasifoliae*, Fitch (choke-cherry aphis).

The chief Aphids attacking the peach are *Myzus* (*Rhopalosiphum*) *persicae*, Sulz. (green peach aphis), and *Anuraphis* (*Aphis*) *persicae-niger*, Smith (black peach aphis), often so numerous as to cause the death of dormant-budded nursery trees.

Red and black currants and gooseberry bushes suffer from infestation by *Myzus ribis*, L. (currant aphis); *Rhopalosiphum lactucae*, Kalt. (sow-thistle aphis); *Myzus dispar*, Patch (green currant aphis); *Aphis varians*, Patch (variable currant aphis); *A. sanborni*, Patch (green gooseberry aphis); *A. houghtonensis*, Troop; *A. neomexicanus*, Ckll.; and *A. ribis*, Sanborn.

The foliage of grape-vines is attacked in some localities by *Phylloxera vitifoliae* (grape phylloxera), but since it chiefly attacks the roots and requires special control measures, it is not dealt with in this bulletin. The young shoots and leaves are often heavily infested with *Macrosiphum illinoisensis*, Shimer, the alternative host-plant of which is the black haw (*Viburnum prunifolium*).

The natural enemies of Aphids include various species of parasitic and predaceous insects and fungous diseases, which exert a very important influence in their control. The principal ones are the larvae and adults of the Coccinellid, *Hippodamia convergens*, the larvae of the Syrphid fly, *Allograpta obliqua*, the larvae of two or three species of lace-wing flies, and a number of parasitic Hymenoptera.

Artificial control by means of contact sprays should be employed in early spring when the buds are beginning to expand, the best insecticides to use being nicotine solution, fish-oil or laundry soap washes and kerosene emulsion; formulae for the preparation of these are given. In addition to these, clean culture, by which the pests are deprived of alternative host-plants, is a remedial work of the first importance.

MORGAN (A. C.) & McDONOUGH (F. L.). **The Tobacco Budworm and its Control in the Southern Tobacco Districts.**—*U. S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 819, July 1917, 11 pp., 2 figs. [Received 1st March 1918.]

Heliothis (*Chloridea*) *virescens*, F. (*rhexiae*, S. & A.) (tobacco budworm), is one of the most important insect pests of tobacco, especially in the southern United States, wherever tobacco is cultivated for cigar purposes.

The damage is done by the small larvae, which eat through the tips of leaves in the developing buds, both in open and covered fields, thereby reducing the yield and rendering the product practically worthless, except as a cigar filler and plug filler.

The eggs are deposited singly on the leaves, usually on the under-side, throughout the growing season, hatching in from 3 to 5 days. On emergence the minute larvae fed sparingly on minute areas of the leaf surface, migrating to the bud in about 24 hours. The larval stage lasts 18–31 days during May and June, at the end of which

pupation in the soil takes place. The moths emerge after a pupal period of 13–21 days, and oviposition begins 4 or 5 days later.

Alternative food-plants of this insect are deer grass (*Rhexia virginica*), geranium and wild Solanaceous plants, especially the ground cherry (*Physalis viscosa*) and *Solanum sieglinge.*

Natural enemies that control the pest to some extent are certain wasps that destroy the larger larvae, and *Toxoneuron* sp., a small wasp-like insect which oviposits in the bodies of the larvae.

Artificial control takes the form of applications of an insecticide in the bud. Experiment has shown that the most efficient combination consists of 1 lb. lead arsenate to 75 lb. maize meal as a carrier. Two applications a week are necessary to protect the buds completely, as the poison is scattered by the rapidly developing leaves. The first 2 or 3 applications are made by the stick and cup method, the poison being sifted upon each plant from a perforated quart cup fixed to the end of a stick. As the plants increase in size, the buds are more tightly folded and the poison has then to be applied by opening the leaves with one hand and dropping a small portion of the poison mixture into the bud with the other.

Antimony sulphide and Paris green are also efficient poisons, which however are not adopted in general practice, the former on account of its expense, and the latter because of the severe scorching it causes when it is used at a strength necessary for budworm control. Maize meal is used as the carrier in preference to gypsum or fuller's earth, as poisons mixed with it are more readily fed upon by the larvae, and also because it has no tendency to cake after showers and thus interfere with the development of the immature leaves.

Clean cultivation is also of the utmost importance, this consisting in the burning of suckers removed from the plants, the cutting down and burning of the plants as soon as the marketable leaves have been harvested, and the destruction of other plants within and around the seed-beds. These latter should always be covered and walled in with cheese-cloth.

McGregor (E. A.). **The Red Spider on Cotton and how to Control it.**—*U. S. Dept. Agric., Washington, D.C.,* Farmers' Bull. no. 831, August 1917, 15 pp., 12 figs. [Received 1st March 1918.]

A notice of the matter in this bulletin, which is a revision of an earlier one, has already appeared [see this *Review*, Ser. A, iv, p. 511].

Chittenden (F. H.). **The Asparagus Beetles and their Control.**—*U.S. Dept. Agric., Washington, D.C.,* Farmers' Bull. no. 837, August 1917, 13 pp., 8 figs. [Received 7th March 1918.]

Crioceris asparagi, L. (common asparagus beetle), a species introduced from the Old World, is an important pest of asparagus, the tender shoots of which are destroyed by the larvae, while older plants and seedlings are defoliated by the adults. The beetle hibernates in the adult stage under convenient shelter, oviposition taking place at the end of April or in May. The eggs hatch in 3–8 days and the complete life-cycle occupies from 4 to nearly 7 weeks, according to climate.

Natural control is effected by predaceous insects, especially the Coccinellids, *Megilla maculata*, DeG., and *Hippodamia convergens*, Guér., *Podisus maculiventris*, Say (spined soldier-bug), *Stiretrus anchorago*, F. (bordered soldier-bug), as well as wasps (*Polistes pallipes*, Lep.) and small dragonflies (*Ischnura posita*, Hagen). The eggs are parasitised by a Chalcid, *Tetrastichus asparagi*, Cwfd.

The best remedial measure for general practice is spraying with lead arsenate solution, composed of 4 lb. lead arsenate paste to 50 U.S. gals. water or Bordeaux mixture, the numher of sprayings depending on local and seasonal conditions.

C. duodecimpunctata, L. (twelve-spotted asparagus beetle) is a somewhat less injurious species, living like the preceding exclusively on asparagus, the chief damage being done by the hibernated beetles, which attack the tender shoots in early spring. Later generations attack the foliage, while a considerable part of the larval stage is passed within the ripening berries. A thorough spraying with lead arsenate, as recommended for *C. asparagi*, should be sufficient for its control.

BURGESS (A. F.). **The Gipsy Moth and the Brown-tail Moth and their Control.**—*U. S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 845, September 1917, 28 pp., 13 figs. [Received 7th March 1918.]

The subject matter of this bulletin has already heen noticed [see this *Review*, Ser. A, ii, p. 294].

RUNNER (G. A.). **The Tobacco Beetle and how to Prevent Damage by it.** *U.S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 846, August 1917, 22 pp., 7 figs. [Received 7th March 1918.]

This bulletin summarises the nature and extent of the damage done by *Lasioderma serricorne*, F. (tobacco beetle or cigarette beetle) to manufactured and stored tobacco. The methods of control by the action of cold, heat or steam, by fumigating with hydrocyanic acid gas or carbon bisulphide, and by treatment with Röntgen rays are described [see this *Review*, Ser. A, iv, p. 385, and vi, p. 183].

WOGLUM (R. S.) & NEULS (J. D.). **The Common Mealy-bug and its Control in California.**—*U. S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 862, September 1917, 16pp., 4 figs. [Received 7th March 1918.]

Pseudococcus citri, Risso (common mealy-bug) and *P. citrophilus*, Claus., are pests which it is impossible to eradicate or satisfactorily control by any single method, such as fumigation, spraying, or the artificial propagation of insect enemies. A recommended form of procedure which combines these is here given, with directions for the preparation of two new sprays.

The formula given for the preparation of cresolated distillate emulsion is :—Distillate (28° Bé.), 2¾ U.S. gals. ; liquor cresolis compositus, U.S.P., 1¾ quarts ; liquid fish-oil soap, 1 quart ; soap powder (sodium carbonate 40–60 per cent., caustic soda 40–60 per cent.), 3 lb. ; water

to make 100 U.S. gals. This spray has been used with success for more than a year, and can be applied to a large variety of plants during the winter season without injury.

Soap powder emulsion is composed of distillate emulsion, 5 U.S. gals.; soap powder, 10 lb.; water to make 100 U.S. gals. This spray is however more injurious to the foliage than the preceding one, and may even cause severe dropping of the leaves unless applied under favourable climatic conditions.

Water sprayed under pressure is being increasingly used with some measure of success, this depending on thorough and repeated applications.

The reduction of the numbers of this pest by natural enemies has already been dealt with [see this *Review*, Ser. A, v, p. 266]. The necessity for measures against *Iridomyrmex humilis*, Mayr (Argentine ant) in this connection has also been noticed [see this *Review*, Ser. A, v, p. 422].

The prevention of the spread of these scales by means of infected picking boxes, sacks and gloves, could be effected by fumigating all boxes with hydrocyanic acid gas, and by dipping sacks, gloves, etc. into gasoline for five minutes to destroy adhering insects or their eggs.

MORGAN (A. C.). **Tobacco Hornworm Insecticide. Recommendations for Use of Powdered Arsenate of Lead in Dark-Tobacco District.**—*U. S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 867, August 1917, 10 pp., 4 tables. [Received 7th March 1918.]

This bulletin supersedes a former one, which has already been noticed [see this *Review*, Ser. A, ii, p. 601]. It contains in addition, in tabular form, a comparison of results obtained in 1916 in Kentucky and Tennessee by the use of Paris green and powdered lead arsenate against the caterpillars of *Protoparce* (*Phlegethontius*) *sexta*, Joh., and *P. quinquemaculata*, Haw., the lead arsenate having been found preferable in many respects.

SASSCER (E. R.) & BORDEN (A. D.). **Fumigation of Ornamental Greenhouse Plants with Hydrocyanic-acid Gas.**—*U. S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 880, October 1917, 20 pp. [Received 7th March 1918.]

The subject matter of this bulletin has already been noticed [see this *Review*, Ser. A, v, p. 244].

BACK (E. A.). **The Silverfish, or "Slicker," an Injurious Household Insect.**—*U. S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 902, October 1917, 4 pp., 1 fig. [Received 7th March 1918.]

This matter contained in this bulletin which supersedes a former one has already been noticed [see this *Review*, Ser. A, iii, p. 587].

YOTHERS (W. W.). **Some Reasons for Spraying to Control Insect and Mite Enemies of Citrus Trees in Florida.**—*U. S. Dept. Agric., Washington, D.C.*, Bull. no. 645, 26th January 1918, 19 pp. [Received 4th March 1918.]

The adoption of a system of spraying for the improvement of orchard conditions is only now beginning to be tested by growers,

who have hitherto trusted to the control of citrus pests by natural agencies, such as entomogenous fungi. Though there may be truth in the contention that it pays better to grow the lower qualities of fruit without treatment, than the better ones with treatment, yet the magnitude of the damage due to the weakening of the trees by scale and whitefly infestation is beginning to be appreciated.

Six species of insects and mites are responsible for 95 per cent. of the damage to citrus trees in Florida. These, in order of destructiveness, are *Dialeurodes citri*, Ashm. (citrus whitefly), *Lepidosaphes beckii*, Newm. (purple scale), *Eriophyes oleivorus*, Ashm. (rust mite), *Chrysomphalus aonidum*, L. (red scale), *Dialeurodes citrifolii*, Morgan (*Aleurodes nubifera*, Berger) (cloudy-winged whitefly) and *Tetranychus telarius*, L. (*sexmaculatus*, Riley) (red spider).

The spraying scheme recommended for the control of these is:—

I. Paraffin-oil emulsion; Government formula 1–66 or 1 per cent. of oil, for use in May. The object of spraying at this time being to kill whiteflies, scale-insects, and to a large extent, rust mites, it should be done after the adults of the first brood of whiteflies have disappeared and before those of the second brood appear, the fruit being then an inch or more in diameter. As this treatment is given before the rainy season begins, it does not interfere with the control work of beneficial fungi.

II. Lime-sulphur solution, 32° Bé., 1–50 to 1–75, for use in June and July. The main object of this application being to kill rust mites, it should be applied before they get very abundant and before any russeting appears.

III. Paraffin-oil emulsion; Government formula 1–66 or 1 per cent. of oil, for use from 25th August to 31st October. The second spraying for whitefly and scale-insects, which will also remove the sooty mould from the trees and enough from the fruits to allow of their being coloured by the sun. Soda-sulphur, 1–50, composed of 30 lb. sulphur, 20 lb. caustic soda and 20 U.S. gals. water, may be added to this spray to increase its effectiveness in killing rust mites.

IV. Lime-sulphur solution, 32° Bé., 1–50 to 1–75, for use in November or December. The object of this spraying being to kill rust mites, it may or may not be necessary, according to the degree of infestation.

It is estimated that treatment on these lines of the 1915–16 crop of oranges and grape-fruit in Florida would have increased the net returns by over £250,000.

ISELY (D.). **Orchard Injury by the Hickory Tiger-moth.**—*U. S. Dept. Agric., Washington, D.C.*, Bull. no. 598, 4th February 1918, 14 pp., 3 plates. [Received 4th March 1918.]

Halisidota caryae, Harris (hickory tiger-moth), the favourite food-plant of which, in spite of its name, appears to be walnut and not hickory, is also a general feeder on the foliage of deciduous trees and shrubs. These, however, serve as food only for the nearly mature larva, the development from egg to pupa mainly taking place on trees of the walnut and hickory family and on pomaceous fruit-trees. The chief injury by this insect is due to the gregarious habit of the larvae in the early stages, when they may strip branches or even small trees of their foliage, the damage in the latter case being sometimes

severe. After the gregarious habit is lost, the larvae scatter so widely that the damage they do becomes inconspicuous.

There is one generation annually, the insect pupating in the autumn and hibernating in the pupal stage on the ground. The moths emerge in early summer, generally about the middle of June, and oviposition may begin 3 days later. The eggs are laid in a broad patch of from 50 to 400 on the under-side of the leaf, all those of one mass hatching almost simultaneously. The larvae, which pass through nine stages, feed gregariously during the first four, being surface feeders during the first stage. During the second stage on walnut, and the third stage on pomaceous fruits, they feed at the edge of the leaf, destroying everything except the stouter leaf veins.

The insect is remarkably free from parasites, only one, *Pimpla pedalis*, Cress., having been recorded.

The control recommended is that of spraying with arsenicals, which, however, must be done before the larvae are in evidence, as in the later stages they are very difficult to poison. Orchards that have been thoroughly sprayed for codling moth are always free from infestation. In the gregarious stages, the larvae are easily collected and destroyed, this being the cheapest and most effective way of dealing with a scattered orchard infestation. In young orchards, which would not be sprayed for codling moth, an application about the end of June of 3 lb. lead arsenate paste to 50 U.S. gals. water would prevent injury by this insect.

HORTON (J. R.). **The Citrus Thrips.**—*U. S. Dept. Agric., Washington, D.C.*, Bull. no. 616, 14th February 1918, 42 pp., 3 plates, 10 figs.

The greater part of the subject matter of this bulletin dealing with *Scirtothrips* (*Euthrips*) *citri*, Moul., has already been noticed [see this *Review*, Ser. A, iii, p. 585]. New information included deals with the history and distribution of the insect, the mode of dissemination, and alternative food-plants, the chief ones being pomegranate, grape, California pepper tree, and apricot. Frost exercises a natural check to a certain extent, but natural control by means of insect enemies is a negligible factor. The most important of these is *Chrysopa californica*, Coq., the larva of which in its early stages feeds upon the larvae of the citrus thrips. Climatic changes and relative inadequacy of the food supply are the chief factors influencing the numbers of this thrips.

DICKERSON (E. L.) & WEISS (H. B.). ***Idiocerus scurra*, Germar, a a Poplar Leaf-hopper.**—*Jl. New York Entom. Soc., Lancaster, Pa.*, xxv, no. 4, December 1917, pp. 218–224, 1 plate. [Received 12th March 1918.]

Idiocerus scurra, of which *I. gemmisimulans*, L. & C., is a synonym, is not a native American species, but was probably introduced from Europe in the egg-stage on Lombardy poplar, which was the first ornamental tree introduced into the United States. It first attracted attention in 1916 on poplars in a New Jersey nursery and is widely distributed in New Jersey on Lombardy poplar (*Populus nigra italica*) and Carolina poplar (*P. deltoides*).

The insect hibernates in the egg-stage, the eggs being laid in groups of 3–6 just beneath the bark of the twigs, above and concealed by the buds. In a severe infestation every part of a young twig is utilised except the tip, as many as 48–50 eggs being found in each linear foot. These over-wintering eggs hatch during the latter part of May, and adults appear at the end of June. Females of this brood oviposit during the first two weeks of July, and the adults of the second brood begin to oviposit by the end of August. The eggs are parasitised by *Gonatocerus maga*, Gir., and also, according to Leonard and Crosby, by *G. ovicenatus* [see this *Review*, Ser. A, v, p. 72]. A bug, *Podisus maculiventris*, Say, has been observed on one occasion to attack an adult.

The damage caused by this insect consists in the whitening and discolouring of the upper surface of the leaves, and in New Jersey, where it is becoming more abundant and widely distributed, it has been found on the poplars lining the city streets. Detailed descriptions of the egg, five nymphal stages, and adult are given.

BAUMBERGER (J. P.) & GLASER (R. W.). **The Rearing of** *Drosophila ampelophila*, **Loew, on Solid Media.**—Separate from *Science, Lancaster, Pa.*, xlv, no. 1149 5th January 1917, pp. 21–22. [Received 13th March 1918.]

The mass of fermenting banana generally used in rearing *Drosophila* is unsuitable for observing the beginning of oviposition. A transparent solid medium of banana agar was therefore used, being made as follows:—Five or six bananas were mashed up in 500 c.c. water, allowed to infuse on ice over-night, and then passed through cheese cloth. Powdered agar-agar was then added at the rate of $1\frac{1}{2}$ grams to 100 c.c. of banana infusion, which was heated till the agar had dissolved. The liquid was then filtered through a thin layer of absorbent cotton into test-tubes.

If adult *Drosophila* are inserted into the tubes and these are incubated at 35° C., small white eggs may be seen to be deposited everywhere on the surface of the agar in a day or two. The fact that the average number of days required to complete the life-cycle on this medium is three days longer than on the ordinary banana mash and that some of the larvae die without pupating, shows that the medium is deficient in available food. Probably the amount of food might be increased by the addition of banana flour.

Drosophila has also been reared on potato agar, but the results were even less satisfactory than with banana agar, showing that the food supply in potato is very small.

Bacterial growths, which always develop on the medium, do not seem to affect the larvae, and fungus growths are usually destroyed by the larvae as soon as they hatch.

BAUMBERGER (J. P.). **The Food of** *Drosophila melanogaster*, **Meigen.**—*Proc. National Acad. Sci., Washington. D.C.*, iii, no. 2, February 1917, pp. 122–126. [Received 13th March 1918.]

During the rearing of *Drosophila melanogaster* on artificial media of fermented banana agar, it was observed that visible fungus growths

did not occur when many larvae were present. These surface growths, which proved to be largely yeast cells, appeared however after pupation, or if only a few larvae are present. It was also found that adult flies, pupae, larvae and eggs invariably carried yeast cells. Experiments showed that a loose symbiosis exists between the two organisms, but that yeast is not present in the eggs or pupae of *Drosophila*.

From the fact that fungus growths disappear in the presence of larvae it was inferred that they fed upon the micro-organisms present, this being established as a fact by experiment, which also proved that the fungus is merely the food of the insect, since the larvae grew more rapidly on abundant dead yeast than on less abundant living yeast. There is also evidence that other micro-organisms may furnish food for these flies.

Similar food relations may be common to a number of organisms, as for example the house-fly, which oviposits only in the presence of the odour of fermentation and always has a certain form of bacteria on its body in great abundance, the larvae being unable to survive in garbage which gives an acid reaction. Those insects that live in unusual media, such as strong salt water and petroleum, may be associated with micro-organisms that have unusual powers of oxidation.

Since *Drosophila* can be reared on a synthetic medium consisting of inorganic salts, sugars and ammonium tartrate, it was supposed to possess a synthetic power as great as that of bacteria. It is, however, the yeast cells that are capable of synthesising the proteins from such a culture medium, and the insect depends on these cells for its proteins, having no greater synthetic power than is common to higher animals. Adult flies do not require proteins, but survive for a much longer period on sugar agar than on yeast agar, while proteins are necessary to the development of rapidly growing larvae.

The habit of the larva of constantly agitating the surface and carrying yeast cells throughout the medium, greatly increases fermentation, and the resulting increase in alcohol may serve as a protection to the larvae against destructive moulds and putrefactive bacteria. The resulting anaërobic conditions may also increase the food value of the yeast cells by increasing the percentage of albumen contained in them.

The number of larvae present determines the extent to which the yeast will be spread though a culture medium, the depth to which the larvae can go below the surface being also an important factor. This depth is determined by the consistency of the medium, since the larvae will go to the depth at which a bubble of air will remain attached to the two projecting posterior spiracles. The moment this bubble is lost the larva goes upward until another is found. Thus a medium of a jelly-like homogeneous consistency would appear to be the best for the artificial rearing of these larvae.

BRUES (C. T.). **Adult Hymenopterous Parasites attached to the Body of their Host.**—*Proc. National Acad. Sci., Washington, D.C.*, iii, no. 2, February 1917, pp. 136–140, 1 fig.

A small parasitic Hymenopteron of the family SCELIONIDAE parasitises the eggs of the Deccan grasshopper (*Colemania sphenarioides*,

Bol.) a species widely distributed in India. A description of this parasite, which probably belongs to the genus *Lepidoscelio*, Kieffer, is given under the name *L. viatrix*, sp. n.

The adult females firmly attach themselves to the abdomen of the locust, their mandibles being imbedded in the body between the abdominal plates. By this means, parasitisation of the eggs can take place immediately after oviposition by the host.

CARVER (G. W.). **How to Grow the Cow-Pea, and Forty Ways of Preparing it as a Table Delicacy.**—*Expt. Sta. Tuskegee Institute, Alabama*, Bull. no. 35, December 1917, 24 pp, 4 figs.

The insect enemies of the cow pea (*Vigna unguiculata*) are few, the worst being the cow-pea bruchus, which attacks it in storage, but which can be destroyed by fumigation with carbon bisulphide, and *Heliothis obsoleta* (*armigera*) (cotton-ear worm), damage by which can be avoided by rotation of crops, clean and rapid cultivation and proper fertilisation.

WEISS (H. B.). ***Gracilaria zachrysa*, Meyrick, in New Jersey (Lep.).**—*Entom. News, Philadelphia*, xxix, no. 3, March 1918, p. 114.

The Microlepidopteron, *Gracilaria zachrysa*, Meyr. (*azaleae*, Busck) was originally introduced into Holland from Japan and infests all Japanese varieties of azaleas, as well as *Azalea indica*, greenhouse azaleas being injured during the winter. In New Jersey it is known to occur in many private greenhouses and is considered a pest of some importance, commercial houses in consequence holding over as little azalea stock as possible from year to year.

The larvae mine the leaves and also fold over the tips, and in some cases they have been suspected of eating through the buds. They may be controlled by means of nicotine extract used either as a spray or a fumigant, by handpicking the infested leaves, or by the use of a stomach poison, lead arsenate paste (at the rate of 8 lb. to 100 U.S. gals. water) having yielded good results.

GLASER (R. W.) & WILCOX (A. M.). **On the Occurrence of a *Mermis* Epidemic amongst Grasshoppers.**—*Psyche, Boston, Mass*, xxv, no. 1, February 1918, pp. 12–15.

Two species of grasshoppers, *Melanoplus atlantis* and *M. bivittatus*, are extremely bad pests of maize, wheat, oats and clover in the State of Vermont, but in the latter part of August and the beginning of September 1917, the rate of mortality among them was found to be unusually high. This proved to be due to the presence of a parasitic Nematode, *Mermis* sp. probably *M. ferruginea*, which is said to be a common parasite of *Locusta carolina* near Philadelphia. This worm, the females of which measure from 2 to 8 inches, was located in the body cavity, generally singly, though in one case as many as 40 were found in one grasshopper. Late in the season, the worms are known to emerge by boring through the body wall, and reaching the earth, slowly bore into the soil and coil up at a depth of 6–12 inches beneath the surface, undoubtedly hibernating in this position.

The percentage of parasitism in female grasshoppers was unusually high, varying from 25 to 76 per cent., that in males being 2–21 per cent.

No males having been found, the life-history is obscure, and the manner in which grasshoppers become infested is not known. The parasite being so large, it is probable that the grasshopper will prove to be only the secondary host. The whole subject is one for further investigation, since the parasite may prove to be worthy of introduction as a natural control in regions where grasshoppers are a pest.

WILCOX (A. M.). *Ascogaster carpocapsae*, **a Parasite of the Oriental Moth.**—*Psyche, Boston, Mass.*, xxv, no. 1, February 1918, p. 17.

The oriental moth, *Cnidocampa flavescens*, Walk., a native of Japan, was first discovered in America in 1906, where there is the possibility of its becoming a widespread pest, though at present the infestation is confined to a small area.

Attempts to rear parasites from the larvae and cocoons of the moth proved unsuccessful till June of 1917, when a single Braconid parasite emerged, which has been determined as *Ascogaster carpocapsae*, Vier., originally described as a parasite of *Cydia pomonella* (codling moth).

FUNKHOUSER (W. D.). **Biology of the Membracidae of the Cayuga Lake Basin.**—*Cornell Univ. Agric. Expt. Sta., Ithaca, N.Y.*, Memoir II, June 1917, 445 pp., 22 plates, 9 figs. [Received 26th March 1918.]

This comprehensive memoir is a summary of seven years' field and laboratory work in the vicinity of Ithaca, New York. The family MEMBRACIDAE, which occurs chiefly in South America, Africa and southern Asia, is represented in North America by only 40 genera, many of these having only a single species. In the northern States, New York yields the greatest number of species, which are, however, not characteristic of the family. The memoir concludes with a bibliography of 261 works.

KEUCHENIUS (P. E.). **Waarnemingen over Ziekten en Plagen bij Tabak (Derde Serie). De Tabaksboeboek** (*Lasioderma*) **en de Tabaksmot** (*Setomorpha*). [Observations on Diseases and Pests of Tobacco. Third Series: The Tobacco Beetle and the Tobacco Moth.]—Reprint from *Meded. Besoekisch Proefstation*, no. 26, 1917, 56 pp., 1 plate. [*sine loco*] [Received 4th March 1918.]

The second of this series of papers on tobacco pests has already been abstracted [see this *Review*, Ser. A, iv, p. 79].

The large stocks of tobacco that have accumulated in the Dutch East Indies owing to the War have increased the importance of *Lasioderma serricorne*, F., and *Setomorpha margalaestriata*, sp. n., as pests of this product.

A description of *L. serricorne* is given, with full biological data, mostly from existing literature. In the Besoeki district (Java) this beetle began to be noticed as a pest of tobacco about 1907. This was probably due to the gradual encircling of the isolated drying sheds by native houses—thus forming permanent foci of infestation—and to the

increasing practice of cultivating an early crop—tobacco being thus placed in the baling sheds twice a year with only a short interval between the two occasions. The attraction exercised by light may be used to ascertain if a warehouse is infested, and it was in one case turned to account by keeping lamps burning throughout the night in a shed where infested tobacco was stored, thus keeping the beetles from escaping through cracks or other openings to adjacent uninfested sheds. Another method of detecting the beetles is by means of a bowl containing a strong sugar solution. Experiment confirmed the view that tobacco leaf is not attacked by the adult beetles. The beetles used in this test lived 23 and 28 days on an average, while those kept with paper lived 31 days on an average, and those with sugar 74 days. Immature larvae placed in a bottle half-full of white sugar were alive 93 days later, but had not pupated. It is improbable that *L. serricorne* attacks white sugar under normal circumstances, for all attempts to infest, from the outside, sugar in a gunny bag failed.

In the author's experiments a temperature varying from 23° to 32° F., over a period of 48 hours, was not sufficient to kill all stages of *L. serricorne.* A period of 120 hours proved fatal to all stages, except that 4 eggs survived the treatment together with some larvae ; the latter however died soon afterwards. Both eggs and larvae should be able to resist a winter of not too great severity in Holland. Tobacco in the interior of the bales is seldom attacked, probably because of the carbon dioxide, ammonia and other gases generated there.

The tobacco moth, though present for years as a pest of tobacco in Besoeki, was first recognised to be a new pest in 1914 and was then described [see this *Review*, Ser. A, iv, p. 81]. R. van Eecke identified it as belonging to the genus *Setomorpha*, and as a result of a careful comparison with van Deventer's description of *Setomorpha tineoides* the author finds it to be a new species, of which he here describes all stages under the name of *Setomorpha margalaestriata.* This Tineid occurs in Java and Sumatra, being very common in the tobacco districts of the former island. The adult oviposits a few days after emerging and does not live more than a week. The eggs are laid in crevices by a long ovipositor. From one female 143 eggs were obtained. Incubation lasts 7–8 days. On hatching the small caterpillars begin feeding and spin loosely woven galleries under which they conceal themselves. The outside of these galleries is covered with black excreta or particles of the leaf-surface. The black excrement characterises the injury done by *S. margalaestriata*, which also usually avoids the larger leaf-nerves. The larval stage lasts about 3–5 weeks and the pupal about 2 weeks, the entire development of one generation requiring about 1½–2 months. Larvae fed on wool, leather and old rags developed into normal adults, and in Java *S. margalaestriata* is a common clothes moth, as well as the allied species, *S. tineoides.* A third clothes moth, *Tinea pellionella*, is often found in the effects of recent arrivals from Europe. *S. margalaestriata* was also found in tobacco seed, coca, maize, stored sunflower seed and in the seeds of some green manure plants. The preference for dark hiding places shown by the moths is a factor in infestation. Moths that had been disturbed were seen to fly up and then seek to enter crevices along the seams of the matting of other bales. Sometimes

the matting itself is attacked, so that a double covering affords no protection. This moth dies in piles of fermenting leaf and attacks the surface-layers only of baled tobacco, probably because of the presence of the gases mentioned above in connection with *L. serricorne.* The larvae usually pupate in the bale close to the covering.

A temperature of 109° F. was found to kill all stages after 5 hours, while a low temperature of 32° F. has the same effect after 120 hours. Thus it may be assumed that *S. margalaestriata* cannot survive the winter in Holland.

The various methods of disinfecting tobacco are very fully reviewed. Experiments were made to see if an economy in carbon bisulphide could be effected by prolonging the fumigation. The following minimum quantities are recommended, either to free tobacco bales from *L. serricorne* or *S. margalaestriata*, or as a precautionary measure: (1) 185 c.c. per 35 cubic feet for a period of 24 hours; (2) 100 c.c. for 48 hours; (3) 80 c.c. for 72 hours. It should be noted that in Besocki 6–8 bales of tobacco average about 105 cubic feet. If the tobacco is not baled or pressed, 32 c.c. per 35 cubic feet will effect disinfection in 36 hours. Other substances also were tested in these experiments, which are described in detail. Acetylene appears to provide a substitute for carbon bisulphide, proving fatal under experimental conditions when 1 oz. of calcium carbide was used per cubic foot. Sulphuretted hydrogen also appears suitable, but the quantities required were not worked out. Hydrocyanic acid gas was found unsuitable. Bales that have been disinfected may become infested again from adjacent infested ones, but if stored in clean warehouses, they may be kept free from attack for years. Other infested produce, such as ground-nuts, cacao, coca, etc., are sources of infestation and this also applies to infested manufactured tobacco imported from Holland. The author suggests that tobacco leaf intended for shipment from Java should be covered by a fumigation certificate issued by the Experiment Stations. Fumigation must take place at least 7 days before shipment in order to ensure that all fumes have dispersed. The wharves must not stack other (non-disinfected) produce near the disinfected tobacco, and the steamship companies must also observe this rule when stowing the cargo. All manufactured tobacco must be disinfected before it is exported from Dutch and other ports.

Both in the bales and in the sweepings other insects are found besides *L. serricorne* and *S. margalaestriata.* A small Ichneumonid of the genus *Norbanus* parasitises the pupae of the former. A mite of the genus *Rhagidia* also occurs, but the author has never observed it destroying the eggs or larvae. A beetle, *Gonocephalum hoffmannseggi*, Stev., which closely resembles *G. acutangulum,* is not uncommon in packing sheds. Its larva attacks maize and rice and probably tobacco. *G. hoffmannseggi* has been found only in tobacco infested with *S. margalaestriata,* and remains of the moth have been found in the stomach of the beetle, which however appears to be only a scavenger, for neither it nor its larva have ever been seen to attack living moths or caterpillars. A Carabid beetle is an active enemy of the larvae of *S. margalaestriata* and of the larvae and pupae of *L. serricorne,* while the larval and adult forms of a Clerid, *Thaneroclerus buqueti,* Lef., actively prey upon *Lasioderma* larvae. None of these natural enemies are of real economic importance.

GRAVATT (G. F.) & POSEY (G. B.). **Gipsy-moth Larvae as Agents in the Dissemination of the White-Pine Blister-Rust.**—*Jl. Agric. Research, Washington, D.C.*, xii, no. 7, 18th February 1918, pp. 459–462.

The white-pine blister-rust (*Cronartium ribicola*) attacks pines ranging from young seedlings to mature trees 80 ft. high. The early occurrence of telia on the leaves of gooseberry and currant bushes, and the fact that the organism is not definitely known to winter on these plants, point to the spread of the disease by aeciospores from pines. The period of aeciospore production coincides with that of the hatching of the larvae of the gipsy moth [*Lymantria dispar*], which eat away the spores and hyphae of the pine blisters, carrying away thousands of spores both on and within their bodies, the viability of the spores remaining unimpaired for a considerable time.

Though wind is considered to be the most important factor in the dissemination of the aeciospores of blister-rust from the pine to the alternative host-plants, *Ribes* spp., yet the fact that gipsy-moth larvae may be blown by winds for distances of 20 miles suggests that they undoubtedly play an important part in the spread of the disease. This view is strengthened by the facts that gipsy-moth larvae have been found feeding on the leaves of *Ribes* spp., in some cases the only infected leaves on these plants being those showing insect injury; that their habit of feeding and crawling on the lower surface of the leaves gives the spores carried on their bodies a good chance of causing infection through the stomata; and that a small percentage of larvae collected from species of *Ribes* near infected pines actually showed aeciospores on their bodies.

FULLAWAY (D. T.). **Division of Entomology.**—*Hawaiian Forester & Agriculturist, Honolulu*, xv, no. 1, January 1918, p. 7. [Received 23rd March 1918.]

During the month of December the insectary handled 35,300 pupae of the melon fly [*Dacus cucurbitae*], from which were bred 1,697 individuals of *Opius fletcheri*. The parasites distributed included:—*Opius fletcheri*, 2,127; *Diachasma tryoni*, 685; *D. fullawayi*, 255; *Tetrastichus*, 500; and *Paranagrus* (corn leaf-hopper parasite) 28,000.

LIZER (C.). **Sobre la Presencia del *Chrysomphalus paulistus*, Hemp., en el Delta del Paraná.** [On the Presence of *Chrysomphalus paulistus*, Hemp., in the Paraná Delta.]—*Physis, Buenos Aires*, ii, no. 12, 30th December 1916, pp. 432–433.

The occurrence of *Chrysomphalus paulistus*, Hemp., is recorded on cultivated plants such as *Laurus nobilis*, L., and *Olea europaea*, L. A minute Acarid has been observed apparently feeding on the eggs of this Coccid.

LIZER (C.). **El *Ceroplastes grandis*, Hemp., nuevo para la Fauna Argentina.** [*Ceroplastes grandis*, Hemp., new to the Argentine Fauna.]—*Physis, Buenos Aires*, ii, no. 12, 30th December 1916, p. 438.

The Coccid, *Ceroplastes grandis*, is recorded from Argentina on *Ilex paraguariensis*.

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GILL (J. B.). **Important Pecan Insects and their Control.**—*U. S. Dept. Agric., Washington, D.C.,* Farmers' Bull. no. 843, September 1917, 48 pp., 54 figs. [Received 7th March 1918.]

The pecan tree (*Carya oliveaeformis*) is subject to the attacks of many insect pests, some of which injure the nuts, some the foliage and shoots, and others the trunk and branches.

The most important insects injuring the nuts are:—*Acrobasis hebescella*, Hulst. (pecan nut and case-bearer), which in its larval stage attacks the immature nuts, one larva often destroying several nuts before attaining its full growth. This moth, as well as an allied species, *A. caryivorella*, Rag., has often been reported as destroying one-third to three-fourths of the total wild pecan crop in Texas. It has three generations during the year and hibernates in the larval stage. Moths from these larvae emerge in May and oviposition begins soon afterwards. The eggs are always laid on the calyx end of the nut and hatch in from 5–7 days. The larvae immediately bore into the young nuts and begin feeding, weaving a tube-like mass of frass and silken threads. The larval period lasts from 22–29 days. and the pupal period for 9–13 days.

Moths of the second generation emerge from the middle of June to the beginning of July, the larvae of this brood being less destructive than the earlier ones. The third generation appears during the first three weeks in August and the larvae do little or no damage to the nuts, which by this time are beginning to harden.

The best method of control against this insect is spraying with lead arsenate at the rate of 1 lb. powder, or 2 lb. paste, to 50 U.S. gals. water, to which should be added the milk of lime from 3 lb. slaked lime. Three applications are required, the first just after the nuts have set, when they are about the size of garden peas, the next a week or ten days later, and the last, four or five weeks after the second application.

Another pest damaging the nuts is *Cydia* (*Laspeyresia*) *caryana*, Fitch (pecan shuckworm), the larva damaging the nut by boring in the husk and preventing its natural separation from the nut shell and the proper development of the kernel. They also lessen the market value of the nuts by leaving a sooty trail on the shells. The earlier generations attack the young green nuts, eating out the interior and causing them to fall, this being especially the case with the various species of hickory which are also attacked. This moth, of which there are from 1 to 3 annual broods, oviposits on either the nuts or the foliage, the eggs, which are laid singly, hatching in about 5 days. The larval stage lasts for three or four weeks, pupation taking place within the green nuts, or in the shucks of mature fruits and lasting for from 9 to 45 days. The insect hibernates in the larval stage in pecan and hickory shucks either on the ground or on trees, the maximum emergence occurring during the last two weeks of March.

The only practicable control measures are the gathering and burning of all shucks immediately after the harvesting of the nut crop, and the cutting down of hickory trees in the immediate vicinity of the orchards.

The nuts are also destroyed by ***Balaninus caryae***, Horn (pecan weevil), an insect very widely distributed throughout the country and

occurring on wild and cultivated pecans and hickory nuts, during August and September. The eggs, to the number of 3 to 7, are deposited in the kernel of the nut which the resulting larvae destroy, afterwards boring their way out to enter the soil, where they pupate and hibernate at a depth of about 6 inches.

A remedial measure recommended is the extensive cultivation of the soil in pecan orchards to destroy the larvae and pupae by exposure to the air and to natural enemies, or the pasturing of pigs in the orchards for the same purpose. Fumigation of the nuts with carbon bisulphide should also prove an effective remedy against this weevil.

The chief insects injuring the foliage and shoots are :—*Acrobasis nebulella*, Riley (pecan leaf case-bearer), an account of which has already appeared [see this *Review*, Ser. A, vi, p. 168]; *Coleophora caryaefoliella*, Clem. (pecan cigar case-bearer) occurring also on hickory and black walnut and controlled by the same methods; *Proteopteryx bolliana*, Sling. (pecan bud-moth), which causes stunted growth and excessive branching by feeding on the terminal buds, but is seldom of sufficient importance to warrant special spraying; *Hyphantria cunea*, Drury (fall webworm), of which there are two generations in the south, the webs being found as early as May; *Datana integerrima*, G. R. (walnut caterpillar), which, however, rarely damages pecan orchards that have been sprayed with arsenicals; *Phylloxera caryaecaulis*, Fitch (hickory phylloxera); and *Monellia caryella*, Fitch (little hickory aphis), which also infests hickory and the California black walnut, doing, however, so little damage to pecan foliage that no special remedial measures are required.

Insects injuring the trunk and branches are :—Termites, of which the most widespread and abundant species in the eastern United States is *Leucotermes flavipes*, Kollar. Young budded and grafted pecan trees have sometimes been killed by termite attacks, the tap-root being completely hollowed out. This has generally occurred in plantations on new land containing an abundance of dead wood and humus. The best remedy is the removal of all decaying wood from orchards and nurseries. Nests, when located, may be destroyed by carbon bisulphide. The moth, *Cossula magnifica*, Strecker, in its larval stage tunnels in the hard wood of the trunk and larger branches, making galleries several inches in length. The only remedy against this pest is the destruction of the larvae in the larger branches and trunk by the injection of carbon bisulphide, the holes being immediately stopped up with putty, grafting wax, wooden pegs, or moist clay. The beetle, *Chrysobothris femorata*, F. (flat-headed apple-tree borer), which also attacks stone-fruit trees [see this *Review*, Ser. A, iv, p. 317], is especially abundant on pecan trees in May, and from mid-August to mid-September. A practicable control measure might be the use of trap-logs, made from newly-cut branches of oak, hickory or pecan, 4–6 ft. in length and 3 to 4 inches in diameter. These, smeared with a viscous substance and placed in the orchard at intervals of 100 ft. or less during the late winter or very early spring should yield valuable results, especially in neglected orchards and those adjacent to extensive woodlands. The beetle, *Xylobiops* (*Sinoxylon*) *basilaris*, Say (red-shouldered shot-hole borer) only occasionally attacks fairly healthy trees, but *Oncideres cingulatus*, Say (hickory twig-girdler) ranks as a first-class pest in the pecan-growing sections of the southern

States. The Longicorn beetle, *Chion cinctus*, Drury, cannot be considered a serious pest, provided that all dead and dying wood is promptly removed and destroyed by burning, this being also the best means of controlling *Elaphidion villosum*, F. (oak pruner), the larvae of which amputate the branches by gnawing a circular groove in the wood, leaving only the bark intact, so that they are brought down by the first strong wind, or even by their own weight.

TURNER (W. F.). **Pecan Insects.**—*Georgia State Board Entom., Atlanta*, Bull. no. 49, January 1918, pp. 1–37, 11 plates. [Received 21st March 1918.]

The greater part of the subject matter of this bulletin has already been noticed [see above], but the following additional species are dealt with:—Moths of the genus *Catocala*, the larvae of which are usually present only in April and May, when they may be controlled by handpicking, arsenical sprays, or burlap bands; *Xyleborinus* (*Xyleborus*) *pecanis*, Hopk. (pecan ambrosia beetle), which attacks trees only when in an unhealthy condition, the removal and burning of wood so attacked being a necessary measure; *Aegeria* (*Synanthedon*) *geliformis*, Walk. (lesser pecan-tree borer), which does not cause any material injury; *Conotrachelus juglandis*, Lec., a weevil, the life-history and control of which have not yet been worked out; and *Diplotaxis excavata*, Lec., a leaf-feeding beetle which, if present in sufficient numbers, can be controlled by spraying on its first appearance with lead arsenate at the rate of 3 lb. paste, or 1½ lb. powder, to 50 U.S. gals. water.

CHASE (W. W.). **Helpful Hints on Dusting Peaches.**—*Georgia State Board Entom., Atlanta*, Circ. no. 24, January 1918, 7 pp. [Received 21st March 1918.]

A dust mixture suitable for spraying peach trees for the prevention of brown rot, peach scab and the attacks of curculio [*Conotrachelus nenuphar*] must contain superfinely ground sulphur and lead arsenate. A third ingredient, hydrated lime, serves several useful purposes, in that it improves the physical properties of the mixture by eliminating the lumps that occur in mixtures of sulphur and lead arsenate, thus allowing the mixture to flow more uniformly from the nozzle. Being cheap, it reduces the cost by displacing the more expensive sulphur, the injurious effect of which it also tends to neutralise.

The proportions of these materials must depend entirely on the number of dustings that are to be given, a higher percentage of sulphur and arsenic being required in a mixture that is to be applied once only. For varieties of peach that require only one application a mixture may be used having the composition sulphur 80 per cent., lead arsenate 10 per cent., hydrated lime 10 per cent., which is also suitable for those varieties that need a second dusting 3–5 weeks after the first. When three dustings are necessary, the first should consist of sulphur 10 per cent., lead arsenate 5 per cent., hydrated lime 85 per cent., to be followed 3–5 weeks later, and again 5 or 6 weeks before the ripening period by one having the composition sulphur 80 per cent., lead arsenate 5 per cent., hydrated lime 15 per cent.

Overdosing must be carefully avoided, as a sulphur dust mixture tends to defoliate the trees and to crack the skin and flesh of the fruit when applied too heavily. It is essential that the sulphur used should be superfinely ground.

Oskamp (J.) & Woodbury (C. G.). **Strawberry Varieties and Cultural Hints.**—*Purdue Univ. Agric. Expt. Sta., La Fayette, Ind.*, Bull. no. 200, 16 pp., 14 figs. [Received 21st March 1918.]

Insects damaging the strawberry include white grubs [*Lachnosterna* spp.], which feed on the roots of a great variety of crops. In the case of a bad infestation, the land should be ploughed and pigs or chickens kept on it. The strawberry leaf-roller [*Ancylis comptana*], which oviposits in early spring, can be controlled by spraying 2 or 3 times at intervals of a week with a solution of 2 lb. lead arsenate paste or 1 lb. powder to 50 U.S. gals. water. The plants should be cut and the patch burned over as soon as the crop is harvested. The strawberry crown borer [*Tyloderma fragariae*] may be held in check by suitable crop rotation, and also by burning over infested areas. Poisons are useless against them. Sawflies, the larvae of which skeletonise the leaves, and strawberry weevils [*Anthonomus signatus*], which destroy the staminate flowers and feed on the pollen, may both be controlled by thorough spraying with lead arsenate.

Oskamp (J.) & Woodbury (C. G.). **Varieties of Blackberries and Raspberries with Notes on their Care.**—*Purdue Univ. Agric. Expt. Sta., La Fayette, Ind.*, Bull. no. 201, August 1917, 12 pp., 6 figs. [Received 21st March 1918.]

Blackberries and raspberries are seldom attacked by leaf-eating insects, but in the event of their appearance, spraying with lead arsenate is an effective control.

The crown borers, which attack the roots or canes near the ground, can only be dealt with by examining each plant and destroying them when found. Plants attacked by the cane borer [*Oberea bimaculata*], which girdles the young canes near the top, must be dealt with by cutting off the affected canes below the girdle and burning them.

Oskamp (J.) & Woodbury (C. G.). **Gooseberries and Currants.**—*Purdue Univ. Agric. Expt. Sta., La Fayette, Ind.*, Bull. no. 207, August 1917, 11 pp., 10 figs. [Received 21st March 1918.]

The four types of insects that attack gooseberries and currants may be controlled as follows:—Scale-insects infesting the stems, by a winter spray of concentrated lime-sulphur, 1 U.S. gal. to 8 U.S. gals. water; leaf-eating caterpillars by poisoning with lead arsenate, 2 lb. paste, or 1 lb. powder, and 2 lb. lime to 50 U.S. gals. water; borers, by cutting out and burning all infested canes in the spring, before the borers emerge; Aphids, by spraying with nicotine sulphate, 1 fluid ounce to 8 U.S. gals. water, with 4 oz. laundry soap added.

Troop (J.) & Mason (P. W.). **Some Common Garden Insects.**—*Purdue Univ. Agric. Expt. Sta., La Fayette, Ind.*, Circ. no. 64, July 1917, 15 pp., 9 figs. [Received 21st March 1918.]

As its name indicates, this bulletin deals with the common insect pests of cabbage, cucurbits, onions, potatoes, maize and tomato and recommends the usual contact and poison insecticides.

Sayre (C. B.) & Woodbury (C. G.). **Mint Growing in Northern Indiana.**—*Purdue Univ. Agric. Expt. Sta., La Fayette, Ind.*, Circ, no. 65, August 1917, 14 pp., 8 figs. [Received 21st March 1918.]

Mint is not usually damaged by insects, though in some seasons cutworms and grasshoppers may become serious pests. They may both be controlled by means of a poisoned bait composed of 50 lb. wheat bran, 2 lb. Paris green, 6 finely chopped oranges or lemons and enough cheap molasses and a little water to bring the mixture to the consistency of a stiff dough. As cutworms feed during the night, and grasshoppers in the morning, the bait should be distributed broadcast in small lumps during the evening.

Reed (H. J.) & Woodbury (C. G.). **The Planting and Care of the Young Apple Orchard.**—*Purdue Univ. Agric. Expt. Sta., La Fayette, Ind.*, Circ. no. 67, August 1917, 20 pp., 14 figs. Received 21st March 1918.]

As a preventive measure against the attacks of insects and diseases, it is advisable to spray a young orchard during the first part of May and again at the beginning of July with a mixture of 1 U.S. gal. concentrated lime sulphur solution (32° Bé.) to 40 U.S. gals. water, 1 lb. of lead arsenate powder or 2 lb. paste, being added to every 50 U.S. gals. of spray solution.

In the event of the appearance of the San José scale (*Aspidiotus perniciosus*), the orchard should be given a dormant spray in spring of 1 U.S. gal. concentrated lime-sulphur solution to 7½ U.S. gals. water.

Reed (H. J.) & Woodbury (C. G.). **Melon Growing in Indiana.**—*Purdue Univ. Agric. Expt. Sta., La Fayette, Ind.*, Circ. no. 68, August 1917, 16 pp., 14 figs. [Received 21st March 1918.]

The chief insects damaging melons are the striped beetle [*Diabrotica vittata*], which attacks the young plants as soon as they appear above ground, and the melon aphis [*Aphis gossypii*], which feeds on the under-surface of the leaves, causing them to curl. The former can be controlled by a mixture of 2 parts air-slaked lime and 1 part tobacco dust. Another mixture that may be sifted over each hill in small quantities consists of land plaster (finely ground gypsum) or sifted ashes, to which a small quantity of turpentine (4 oz. to a peck of ashes) has been added. No successful method of dealing with this pest on a large scale has yet been devised.

Aphis gossypii has been successfully dealt with by spraying the under-side of the leaves with a dilute nicotine solution, using 1 part 40 per cent. nicotine sulphate solution to 800 parts water, which is about equivalent to 1 pint to 100 gals. water.

OSKAMP (J.) & WOODBURY (C. G.). **Peach Growing in Indiana.**—*Purdue Univ. Agric. Expt. Sta., La Fayette, Ind.,* Circ. no. 69, September 1917, 24 pp., 15 figs. [Received 21st March 1918.]

Insects injurious to the peach are the curculio beetle [*Conotrachelus nenuphar*], the black peach aphis (*A. persicae-niger*) and the peach tree borer [*Aegeria exitiosa*].

The curculio which oviposits in the young fruit, causing it to become knotty and exude gum, may be controlled by spraying with lead arsenate at the rate of 2 lb. paste, or 1 lb. powder, and 2 lb. lime to 50 U.S. gals. water.

In cases of black peach aphis infestation the under-sides of the leaves should be thoroughly sprayed with 1 pint of 40 per cent. nicotine sulphate to 100 gals. water.

The peach-tree borer can be successfully dealt with only by the method of worming, or cutting out the larvae from the trunk, during August and September. The operation may be simplified by mounding up the earth at the base of the trees before egg-laying begins in June, thus compelling the larvae to enter the trunks at a higher level, where they can be more easily reached.

DEN DOOP (J. E. A.). ***Lasioderma* en *Anobium* in Koriander- en Karwei-Zaden.** [*Lasioderma* and *Anobium* in Coriander and Caraway Seed.]—*Meded. Deli Proefstation, Medan,* x, no. 8, December 1917, pp. 190–202. [Received 20th March 1918.]

As a result of the circular drawing attention to coriander (*Coriandrum sativum*) and caraway (*Carum carui*) as hosts of *Lasioderma serricorne* [see this *Review*, Ser. A, v, p. 417], 88 samples of coriander and 85 of caraway were received from 54 estates. Of these, 19 of coriander (22 per cent.) and 44 of caraway (52 per cent.) were infested with *L. serricorne*. In the 88 coriander samples, 38 individuals of *L. serricorne* were found (0·4 per sample) and 468 in the 85 samples of caraway (5·5 per sample). Of the 54 estates, 33 per cent. suffered from infested coriander and 63 per cent. from infested caraway. The number of estates where *L. serricorne* occurred—in either or both seeds—was 78 per cent. In 41 per cent. of these caraway alone was infested. The greater attractiveness of caraway seed is therefore apparent.

There does not appear to have been any direct relation between the infestation of these seeds in a given estate and the infestation of the same estate's tobacco crop in 1916. This does not imply that these seeds may not be dangerous, as the presence of any *Lasioderma* beetles near the tobacco may start an infestation. Two other products, however, are still more important sources of infestation. The first is the tobacco which the work-people bring with them into the fermenting and sorting sheds, while the second is the dried root of *Curcuma longa*, used as a medicine, dye-stuff and spice. This latter is highly attractive to *L. serricorne* and favourable to its development. As coriander and caraway are usually stored in separate divisions of the same box together with this root, it is probable that they become infested from it and the data collected seem to confirm this.

In examining the samples it was found that the injury done by *L. serricorne* to these products was unimportant compared with that

of other insects, of which the chief was the beetle, *Anobium paniceum*, L. As at first sight this Anobiid might be mistaken for *L. serricorne*, some of the distinctions between them are mentioned. *A. paniceum* appears to be a constant pest of both caraway and coriander. It is parasitised by a small black Hymenopteron, as yet unidentified, and experiments show that this parasite is also able to live in *L. serricorne* and probably does so under natural conditions. *Anobium* larvae in coriander seed were parasitised twice as much as in caraway. Up to the present no injury to fermented tobacco by *A. paniceum* has been observed on the East Coast of Sumatra. It has been recorded in North America as a very unimportant pest in this connection.

The whole of the investigations recorded point to the necessity for inspecting strictly the estate shops, as they provide conditions favourable to *L. serricorne.* Infested *Curcuma* root may be disinfected with about 10 c.c. of carbon bisulphide used in a kerosene tin.

HONING (J. A.). **The Destruction of Tobacco Plants after Harvesting, a necessary Measure against** *Phthorimaea operculella*.—*Med. Deli Proefstation, Medan*, x, no. 8, December 1917, p. 208. [Received 20th March 1918.]

A circular is published advising that all tobacco plants be uprooted and burnt after the harvest, as numerous side-roots are developed and the lowest of these remain alive for months after the main root has perished. In the side-roots of three tobacco plants left standing no less than 20 living larvae of *Phthorimaea operculella* (*Lita solanella*) were found, together with 6 empty pupal cases.

ROEPKE (W.). **Verslag over het Jaar 1916-17.** [Report on the Year 1916-17.]—*Meded. Proefstation Midden-Java, Salatiga*, no. 28, 1917, pp. 10–33. [Received 23rd March 1918.]

The important question of the food-plants of *Acrocercops cramerella* (cacao moth) received attention during the year. In 1913, *Cynometra cauliflora* was found to be an important food-plant of this pest in spite of the fact that it is an introduced plant from India, where the moth is unknown. Neither the indigenous *Cynometra ramiflora* nor a related plant, *Maniltoa gemmipara*, appear to be attacked by the cacao moth. Up to the present some small moths, related to *A. cramerella* and probably new to science, have been found on *Saraca declinata*, *Bauhinia variegata* and other plants of this genus, *Caesalpinia sappan* and *Jatropha curcas*. All these moths are attacked by parasites and these plants may prove useful, if grown near cacao, as the parasites of *A. cramerella* may thus find hosts among them at the time that the operations known as "rampassen" [see this *Review*, Ser. A, i, p. 57] are being carried out.

This report also contains abstracts from the departmental report of Mr. P. van der Goot. An investigation, as yet incomplete, was made to determine if *Helopeltis* actually oviposits and its larvae develop on various plants commonly believed to be food-plants of this pest. In addition to cacao it can be definitely said that *H. antonii* can develop fully on *Anona muricata* (sour sop), *Bixa orellana*, *Ceiba pentandra*, *Eryngium foetidum*, *Melastoma malabathricum*, *Psidium*

guajava (guava) and *Stachytarpheta indica*. *Helopeltis* injury and *Helopeltis* eggs were noticed on *Capsicum annuum, Chrysanthemum frutescens, Cynometra cauliflora, Mangifera* sp., *Nephelium lappaceum* and *Tamarindus indicus*. In spite of repeated tests *Helopeltis* was not seen to oviposit on *Ageratum conyzoides, Artocarpus integrifolia, Bidens* sp., *Durranta plumieri, Ficus* sp., *Tephrosia candida* and *T. vogelii*, though in the case of the two last-named a planter has reported the presence of larvae on them [see also this *Review*, Ser. A, v, p. 415]. Tests seem to show a marked preference of *Helopeltis* for cacao over *E. foetidum, M. malabathricum* and *Tephrosia*, so that these plants cannot be used as traps.

A serious infestation of the seeds of various species of cowpeas by the small Bruchid, *Bruchus* (*Pachymerus*) *chinensis*, L., led to observations by Mr. Van der Goot on its habits, as there seemed to be special ground for fearing its capacity for injuring the seed of *Tephrosia candida* and other important green manure crops. The eggs are laid in the stored seed of various Leguminosae, and the larvae hatch out in about 4 days and bore into the seed directly beneath the egg. Both larvae and pupae are completely hidden within the seed. The adult gnaws a round hole in the skin of the seed. It mates a few hours after emergence and begins to oviposit within 24 hours. It does not live more than a fortnight. The entire development of *B. chinensis* is short, occupying from 28 to 32 days. From 50 to 70 eggs are laid by a female and of these at least 60 per cent. develop into adults. A small unidentified Chalcidid parasitises the larvae; it appears to develop in 21–23 days. *B. chinensis* does not attack all Leguminosae to the same degree. *Arachis hypogaea* (ground nut) and *Cajanus indicus* (pigeon pea) appear to suffer very severely. The beetle also seems to develop perfectly in *Vigna catjang* var. Though eggs were laid in captivity in the seeds of *Glycine soja* no larvae developed. On the seeds of *Tephrosia candida* and *Leucaena glauca* only a few eggs were laid and they did not develop. According to Chittenden, *B. chinensis* oviposits in the open in the flowers of various Leguminosae, but an investigation of this point with *T. candida* proved negative. The larvae of another Bruchid, as yet undetermined, were sometimes found in the pods of *T. candida*.

MATHESON (R.). **The Poplar and Willow Borer.**—*Cornell Univ. Agric. Expt. Sta., Ithaca, N.Y.*, Bull. no. 388, April 1917, pp. 457–483, 1 plate, 17 figs. [Received 27th March 1918.]

The subject matter of this bulletin has already been noticed from another source [see this *Review*, Ser. A, iv, p. 69].

KNIGHT (H. H.). **A Revision of the Genus *Lygus* as it occurs in America north of Mexico, with Biological Data on the Species from New York.**—*Cornell Univ. Agric. Expt. Sta., Ithaca, N.Y.*, Bull. no. 391, May 1917, pp. 555–645, 1 plate, 50 figs. [Received 27th March 1918.]

This revision of the genus *Lygus* has been undertaken owing to the need among economic entomologists of a systematic work to aid in the accurate determination of the species.

It includes the well-known tarnished plant-bug, *Lygus pratensis*, L., a cosmopolitan pest of long standing on a variety of plants of economic value. Other species such as *L. invitus*, Say, and *L. communis* var. *novascotiensis*, Knight, during the past five years have become serious pests of pears and apples; hence there is a strong probability that other forms now present on native wild vegetation may change their food-habits and attack cultivated plants. A list is given of 67 species and varieties arranged in 6 sections, 34 species and 10 varieties being described as new.

A bibliography of 78 works is appended.

KONDO (T.). **Ni-san-ka Meichu.** [The Two- and Three-brooded Rice-Borers.]—*Rinji-hokoku* [Extra Report], *Nagasaki Agricultural Experiment Station*, no. 18, 20th May 1917, 8 plates, 103 pp.

This report describes in detail the morphology, life-histories, habits and methods of control of two moths, viz:—*Chilo simplex*, Butl., commonly known as the two-brooded rice-borer, because it has two generations, and *Schoenobius incertellus*, Wlk. (*bipunctifer*, Wlk.), the three-brooded rice-borer. These two insects are the most important rice pests in Japan.

All the stages of *Chilo simplex* are described in detail. It winters within cut-off stems or stumps as a larva, which pupates at the end of March or April and appears as an adult from the beginning of May to July. The moth oviposits on the rice leaves and the resulting larvae bore in groups into the stalk of the plant, causing withering of the heart. These larvae, after having devoured the contents of the stalk, pupate in the middle or end of August. The adults appear at the end of August or the beginning of September. The next generation of larvae again bore into the stalks, injuring the leaf-sheath en route. The first evidence of injury by this pest is therefore a change in the colour of the leaf-sheath, which is followed by a withering of the ear. The fully fed larvae of the second brood hibernate mainly in the cut stalks and pupate in the following year. The moth, which hides by day and becomes active at night, is readily attracted by lights. The eggs are laid in masses of 2,500–3,000, or more, though a female may deposit from one to twelve masses containing about 200 eggs on an average. The eggs of the first brood are usually laid on the upper surface of the leaf near the tip, while those of the second are found at the point of juncture of the leaf-sheath and the stalk. When the larva bores into the young rice plant in the field after transplanting, the leaf-sheath is often injured with the result that the leaf falls and floats on the water, these floating leaves being considered a sign of injury by the first brood larvae, whereas a change in the colour of the leaf-sheath is similarly characteristic of infestation by the second brood. Well-developed and manured plants suffer more injury than weakly ones. Though this borer winters chiefly in the stubble of rice-plants, it may also hibernate in the stems of *Amarantus blitum*, *Cephalotaxus drupacea*, *Cyperus iria*, *Andropogon sorghum*, *Eleusine indica* and *Scirpus eriophorum*.

As regards preventive measures collection of the moths may be effected either with nets or trap lanterns. Of the latter the author describes 37 different types and quotes the results of experiments with these at the Kiushiu branch of the Imperial Agricultural Experiment

Station. Doubts have been expressed as to the efficacy of these lanterns, because it frequently happens that male moths or females that have already oviposited are the only ones trapped by this means. In another case various injurious insects were only attracted to the field, but not killed by the lantern, while many beneficial ones were destroyed in it. Other measures are collection of the egg-clusters, removal of the outer and more vigorous shoots in which larvae tend to collect, and gathering the floating leaves which often enclose the larvae. Cutting off the infested stalks early in July is very effective in exterminating the first brood larvae. Submerging the rice stubbles is also effective, if care be taken to prevent the escape of floating larvae. Removal of the stalks on which the leaf-sheath has changed colour is the best measure against the second brood larvae. This should be done from the end of August till the end of September. Special treatment of the rice straw is of importance; as this is utilised for various purposes, total destruction is impossible. It should either be tightly heaped in order to prevent the emergence of moths from the larvae that are enclosed in it, or it should be closely covered with mats or similar material so as to prevent the escape of the adults. Soaking the straw in hot water or fumigation with carbon bisulphide may in certain cases be practicable. Raking over the heaps of straw in the spring, when the hibernated larvae are emigrating, is also considered an effective measure. Burying or burning the stubble and removal of weeds around rice fields may also be of some value.

The second part of this report deals with *Schoenobius incertellus*, Wlk., of which all the stages are described in detail. This moth usually appears three times a year, though in certain places there are only two generations. The larva passes the winter within the rice stubble and pupation takes place in April or May of the following year, the moths of the first brood appearing shortly afterwards. These oviposit on the rice-leaves near the tip. The larvae hatched from these eggs bore into the stalk and pupate in July, and those of the next generation in the latter part of August. The moths derived from these give rise to the hibernating larvae.

In habits *S. incertellus* differs from *C. simplex* mainly in the following points. In *S. incertellus* the egg-cluster is covered with hairs from the body of the parent, while in *C. simplex* it is naked. In the case of *S. incertellus* the eggs are always laid at the tips of the leaves, while in *C. simplex* they are laid in the leaf-sheath in the case of the second generation. In the former species the larvae that hatch from the egg-cluster bore one into each rice-stalk, whereas in the latter species they all collect in a single stalk; so that in the former case the injury is widespread, while in the latter it is more concentrated. In the case of *S. incertellus* each rice-stalk being only moderately injured, it continues to stand in the field without losing its original green colour; while injury by *C. simplex* causes the stalk to become bleached and usually to break down. As the larva of *S. incertellus* bores directly into the rice stalk, without affecting the leaf-sheath, the changed colour of the latter, so characteristic of infestation by *C. simplex*, is never seen. The larvae of the last brood of *C. incertellus* pass the winter mainly within the stump of the plant, while those of *C. simplex* do so chiefly in the cut-off stems and only occasionally in the stump.

Upon the whole *S. incertellus* is responsible for the more serious damage. Remedial measures against *S. incertellus* are similar to those against *C. simplex*. The best of all, since the larvae of this species have to pass the winter within rice stubble, is burning, cutting or burying the stubble and stumps or submerging them in water.

The natural enemies of these two borers, besides insectivorous birds and predaceous insects, include two unidentified parasites infesting the eggs and *Amyosoma chilonis*, Vier., *Ophionellus biguttatus*, Mats., *Apanteles (Stenopleura) chilocida*, Vier., *A. simplicis*, Vier., *Lissonota japonica*, Mats., *Chelonis munakatae*, Mats., and *Microplitis aomoriensis*, Mats., infesting the larvae. A few biological notes on some of these are given.

TAKAHASHI (S.). **Tokuyosakumotsu no gaichu to shiteno okinkamemushi ni tsuite.** [*Chrysocoris grandis*, Tbunb., an injurious Insect of a special Crop.]—*Konchusekai* [Insect World], *Gifu*, xxii, no. 1, 15th January 1918, pp. 6–11, 1 fig.

Aleurites cordata is generally planted as a useful tree in Japan, and oil is obtained from the fruit. No insects injurious to this tree seem to have been recorded until recently, when the author has observed the Limacodid, *Parasa consocia*, Wlk., an undetermined Tortricid, and the Pentatomid bug, *Chrysocoris grandis*, Thunb., to do no small degree of injury to it. The two former insects damage the leaves, while the latter, though it has hitherto been regarded as a rare insect in Japan, is found in abundance and punctures the fruit of *Aleurites cordata* with its rostrum, causing it to fall before it is ripe. The adult and nymphal stages and the life-history are described. It has probably two broods a year and passes the winter in the adult stage, ovipositing on the lower surface of the leaf in July. The newly hatched larvae at first attack the leaves and then the buds, inflicting however only minor injuries on the plant at this stage. Adults of this generation appear in August and these, as well as the nymphs arising from them, begin to attack the fruit. The ripe fruit having a hard shell can withstand attack, but unripe fruit sooner or later falls and decays. The adults of the second brood may be seen as late as November, and possibly hibernate under stones. The author believes that Tsuruga and its vicinity is the only infested locality, and that contrary to the opinion of Professor Matsumura, this insect may not be universally distributed throughout Japan. As a remedial measure, the insect may be killed on the trees by means of pine-torches. Kerosene emulsion mixed with insect powder may also be effective against the young nymphs, but has not yet been tested on the spot.

JEPSON (F. P.). **Division of Entomology.**—*Dept. Agric. Fiji, Ann. Rept. for the Year 1916, Suva*, 20th November 1917, pp. 16–25. [Received 1st April 1918.]

Bananas in Fiji during the year under review were attacked to some extent by *Cosmopolites sordidus* (banana borer), though the damage done was slight, probably owing to the wet season. The scale, *Aspidiotus destructor* (*transparens*) was prevalent throughout the year, spraying having been interfered with by the excessive amount

of rain. Fruits left to ripen naturally were pierced by fruit-sucking moths, the fruit-fly (*Drosophila ampelophila*) ovipositing later in the punctures. The natives protect the young bunches from the larvae of the scab moth [*Nacoleia octosema*], which attack them as they are forming, by placing in them the leaves of an unidentified bush which destroy or repel the larvae.

Observations of *Levuana iridescens* (coconut leaf moth) have shown that this insect does not migrate or hibernate, but carries on its development through the ordinary stages from May to August in very limited numbers and only on certain individual palms. This apparent disappearance each year seems to be due to the wholesale destruction of the larvae by the bug, *Canthecona cyanocantha*, Stål, which develops rapidly and preys on them voraciously at the time when the attack of *L. iridescens* is at its worst. An unidentified Attid spider is also a formidable enemy of the larvae and adults of *L. iridescens*. Considerable damage was also done by the larvae of this moth to *Oreodoxa regalis* (royal palm), *Sagus vitiensis* (sago palm) and *Areca catechu* (betel or areca nut) in the Botanical Gardens, Suva, where they might be checked by spraying with 30 oz. lead arsenate to 25 gals. water. Coconuts were also attacked by *Aspidiotus destructor*, found also on avocado pear, rubber, papaw and ginger. It can be effectively dealt with by spraying, though only young palms could be treated in this manner. Considerable damage was done to young coconuts in some localities by swarms of Phasmids. On young trees they are best dealt with by handpicking. In the case of older trees, they may be made to release their hold and fall to the ground by lighting a fire giving off dense smoke at the base of the tree. By this means also, the eggs that are dropped to the ground by the female are destroyed. Minor pests of coconut during the year were *Promecotheca reichei* (coconut leaf-miner) and *Trachycentra calamias*, Meyr., boring in the base of coconut leaves.

Cacao leaves were often badly damaged by *Adoretus tenuimaculatus*, Waterh. (Japanese rose beetle), a pest difficult to deal with by artificial means, but successfully controlled in Hawaii by a species of *Scolia*. *Phthorimaea operculella* (tobacco leaf-miner) caused damage to young plants in nurseries.

Oranges were punctured by a fruit-piercing moth, probably *Othreis fullonica*, L., which oviposits on the leaves of *Erythrina indica*, the larval period occupying 21, and the pupal, 17 days. The eggs are parasitised by Chalcids, while a black ant devours the eggs, larvae and pupae. The so-called hornets (*Polistes hebraeus*) also attack the full-grown larvae. Attacks of *Chionaspis citri* (orange snow scale) and *Chrysomphalus* (*Aspidiotus*) *aurantii* (California red-scale) were reported, but these pests are easily controlled by spraying with lime-sulphur solution. A fruit-fly, *Dacus passiflorae*, was occasionally found attacking mandarins, but the damage being insignificant, no special treatment is necessary. An unidentified fruit-fly attacked kavika fruit (*Eugenia* sp.).

A Sphingid moth was found destroying the leaf surface of *Colocasia antiquarum*. If attacks, which occur from June to October, become serious, they should be easily controlled by arsenical sprays.

Euscepes (*Cryptorrhynchus*) *batatae*, Waterh. (sweet potato weevil), caused considerable damage to sweet potatoes (*Ipomoea batatas*) on

one estate, no method of dealing with this pest in the growing crop being known at present. It is recommended that diseased tubers and all trash should be destroyed by burying with lime and that planting should be undertaken on fresh ground.

The scale, *Chionaspis dubia*, Mask., was reported as attacking several species of ferns, and the larvae of *Prodenia litura*, the flowers of begonia, other flowering plants.

The Agromyzid lantana seed-fly, introduced from Hawaii in 1911, appears to be thoroughly established and to be exercising an important check on the troublesome lantana weed.

PETHERBRIDGE (F. R.). **The Control of the Apple Capsid Bug by Spraying.**—*Jl. Bd. Agric., London,* xxiv, no. 12, March 1918, pp. 1401–1410, 8 figs.

The experiments recorded in this paper are a continuation of those carried out during the season of 1916 [see this *Review*, Ser. A, v, p. 290]. Observations on the amount of damage done by *Plesiocoris rugicollis* (apple capsid bug) throughout the season showed marked reduction due to spraying. Details of the experiments are given. Soft-soap and nicotine, and soft-soap and pyridine, both proved effective washes against Capsids; for the former, with soft water 10 lb. of soap per 100 gals. or even less is sufficient, but with hard water more may be necessary; from 7 to 8 oz. of nicotine is required. The best time for spraying varies with the season, but, as a rough guide, about 10 days after the first markings of the leaves by the Capsids the first spray should be given, as then most or all of the bugs will have hatched. The date is usually about a week before blossoming. When two sprays can be given, these should be once before blossoming and once just after blossoming. As eggs are laid in the twigs, care should be taken not to plant nursery stock from an infested area in a non-infested one.

LEES (A. H.). **Nicotine-Paraffin Emulsion.**—*Jl. Bd. Agric., London,* xxiv, no. 12, March 1918, pp. 1411–1415.

Suggestions for the best contact insecticides for certain sucking insects are given in this paper with a view to reducing the number of spraying operations wherever possible, while labour is so difficult to obtain. In the author's opinion, the most satisfactory spray is a 2 per cent. paraffin emulsion. Used alone this emulsion is capable of killing Aphids and many other sucking insects, but is not powerful enough to kill Capsids, caterpillars or beetles. The addition of ½ per cent. of nicotine renders it much more efficacious. The formula is then:—soft soap, 20 lb.; paraffin, 2 gals.; nicotine, ½ lb.; water, 100 gals. The soft soap is first dissolved in 5 to 10 gals. of boiling water. The paraffin is then taken up in a garden syringe with a rose attached and squirted violently into the soap solution, thus obtaining an emulsion. The nicotine is then added and the mixture diluted to 100 gals. in all. Capsids are killed when thoroughly wetted by this spray, while larvae of the cabbage white butterfly [*Pieris brassicae*] remained motionless on the leaves and finally died. Larvae of the gooseberry sawfly [*Pteronus ribesii*] when hit by the fluid fall to the

ground. If thoroughly wetted they die, but if only slightly wetted they recover and crawl up the bush again. It is therefore advisable to follow the first spraying with a second treatment of the ground underneath the bushes. This fluid is only intended to replace lead arsenate against this pest when there is danger of poisoning the fruit. The raspberry and loganberry beetle [*Byturus tomentosus*] has been found very difficult to control. The usual method has been to shake the canes in the spring, when the beetle appears, over tarred sheets or into pans covered with tree grease. This is useless, as the beetles can only be dislodged by picking them out. A trial with nicotine-paraffin emulsion showed that while the insects that were thoroughly wetted were killed, those slightly wetted simply moved elsewhere. It was therefore found necessary to carry out a preliminary spraying to draw the beetles into the open; paraffin emulsion alone was sufficient to do this. After five minutes this was followed by a second spray with nicotine-paraffin emulsion. This double spraying was done three times, once a week, and was then stopped for fear of scorching the leaves. The results were satisfactory; no damage was apparent to the flowers or the set of the fruit. Fungicides containing salts of ammonium, potassium or sodium may be added to this spray, but not lime-sulphur, Bordeaux or Burgundy mixtures.

It is noted that though nicotine itself is safe to use on fruit that will shortly be eaten, nicotine sulphate is not volatile and remains on the fruit for a considerable time.

MALLY (C. W.). **Natural Enemies of the Argentine Ant, *Iridomyrmex humilis*, Mayr.**—*S. African Jl. Sci., Cape Town*, xiv, no. 5, December 1917, pp. 245–247. [Received 2nd April 1918.]

Iridomyrmex humilis (Argentine ant), of which a full account has already appeared [see this *Review*, Ser. A, i, p. 325], is a serious insect pest in S. Africa, where it is practically free from natural enemies. The fact that it is not regarded as a serious pest in its native country of S. America, seems to point to the existence there of other species of ants, the absence of one or more of which in certain parts would account for its greater abundance in those districts [see this *Review*, Ser. A, ii, p. 252]. Although practically immune from attack, this ant is very aggressive, no other species of ant except an occasional colony of *Dorylus helvolus* having been found at the Cape in areas infested by it. In view of the difference in behaviour of this ant in countries where it is native and introduced, efforts should be made to arrive at the facts of the case, so that the introduction of controlling agents may be undertaken, should this be deemed advisable.

JACK (R. W.). **The Maize Beetle (*Heteronychus mashunus*, Pering.).**—*Rhodesia Agric. Jl., Salisbury*, xv, no. 1, February 1918, pp. 10–15, 2 plates.

Heteronychus mashunus (maize beetle) has caused considerable loss to maize growers in various parts of Mashonaland and Matabeleland for some years past. The beetles become active with the first heavy

rains, remaining under the surface of the soil during the day and crawling or occasionally flying at night. Moist soil is absolutely essential to them, specimens in confinement having survived for a year or more in wet soil. It is however unlikely that a large proportion survive the winter in the field and they are not observed in any numbers after February. Eggs are laid during the wet season a few inches below the surface of the soil in small pockets in the tunnels made by the beetle, the incubation period being about 15 days. The grub feeds entirely upon decayed vegetable matter in the soil, and there is no evidence that it injures plants in any way during this stage of its development. Winter is passed mainly in the grub stage, though larvae hatching in September and October develop very quickly and may produce adults in December to February. Pupation apparently occurs during late September and early October; the adults frequently leave the pupal skin but remain within the cell until heavy rains produce favourable conditions for their emergence. The pupal cells are constructed about four inches below the surface of the soil, the pupal stage occupying between 3 and 4 weeks. The most serious injury is that caused to maize, the natural food of the beetles probably consisting entirely of succulent grasses. Maize, kaffir-corn, wheat, oats and barley have all been attacked in experimental cages. The insects attack the seed as it germinates and the plant at almost any stage of its growth. The young shoot from the seed is frequently destroyed, so that the plant does not appear above ground. In larger maize plants the beetle eats into the stalk an inch or two below the soil surface, causing the centre of the plant to wither though the outer leaves may still be green, and plant after plant is thus injured by one insect.

The grubs can only exist in rich, low-lying land, though the beetles may range further afield and do damage on lighter soils adjacent to their breeding ground. It is obvious that the presence or otherwise of suitable breeding grounds determines whether the beetles can increase sufficiently to constitute a serious pest. The greatest damage has been recorded on land that has been under cultivation for a number of years, Probably cultivation encourages the pest by making the soil easier for the grubs to penetrate; as they are not dependent upon growing plants for nourishment the lack of natural vegetation would not affect them. Numerous attempts to attract the beetles to poisoned bait of arsenic in sugar or treacle solutions have failed. The practice of collecting the beetles by children is a slow method. Unfortunately experiments with remedial measures have as yet been impossible, but the following methods which apply to the breeding places only, are suggested as worthy of experiment. Improved drainage is likely to check the increase of the pest. Ploughing the area in late summer and leaving the surface in ridges during the dry season should render the land dry to a greater depth than would otherwise be the case.

By ploughing and cross-ploughing from the beginning of October and breaking up the soil as much as possible, numbers of the pupal cells would be crushed and the inmates destroyed. Pigs show a great partiality for these grubs and, if kept on the breeding ground as much as possible between March and September, would probably devour or destroy most of them.

VEITCH (R.). **The Cane Beetle Borer in Australia.**—*Colonial Sugar Refining Co., Ltd., Sydney,* Agric. Rept. no. 3, December 1917, 15 pp., 1 plate. [Received 2nd April 1918.]

Rhabdocnemis obscurus, Boisd. (cane beetle borer) was introduced into Australia from New Guinea, and now threatens to become a formidable pest in the cane districts of North Queensland. Details of the habits and life-history and measures for the control of this weevil are given [see this *Review,* Ser. A, v, p. 52]. The damage done is often very severe and the losses due to it are generally under-estimated. In badly infested districts there is very little sound tissue left in the stalks, and in addition, chemical changes resulting in a reduced sugar yield are set up in the tissues adjacent to the tunnels. Bored cane is also liable to break and fall to the ground, where it becomes further infested and rots rapidly. The extent of this damage depends on the variety of cane, being much greater in the softer kinds.

Damage due to *R. obscurus* must not be confused with that done by the cane moth borer [*Phragmatiphila truncata*], the larva of which girdles the stalk in the region of the nodes, rendering it liable to snap in the middle. It also attacks the green tops of mature cane and young shoots, causing the green hearts of the latter to wither and die.

BRITTAIN (W. H.). **Two Important Vegetable Pests.**—*Nova Scotia Coll. Agric., Truro,* Circ. no. 26, December 1917, 2 plates. [Received 2nd April 1918.)

The moths dealt with in this circular are *Gortyna micacea,* Esp. (potato stem borer), and *Ceramica picta,* Harr. (zebra caterpillar). The former also attacks rhubarb, maize and sugar beet. Its present prominence as a potato pest is due to the widespread cultivation of potatoes on waste land formerly overgrown with weeds.

Ceramica picta (zebra caterpillar) is a periodic pest and only rarely occurs in destructive numbers. Details of its life-history have already been noticed [see this *Review,* Ser. A, i, p. 400]. Where cheap labour is available and when the infestation is on a small scale, control by handpicking and by destroying the leaves bearing eggs or newly hatched caterpillars is the best method. In the case of large areas, dusting with powdered calcium arsenate, lead arsenate, or Paris green, diluted with 8-10 parts of hydrated lime, and applied by means of a powder gun at a time when the larvae are young, gives satisfactory results.

METCALF (C. L.). **Syrphidae of Maine. Second Report: Life-History Studies.**—*Maine Agric. Expt. Sta., Orono,* Bull. no. 263, August 1917, pp. 153-176, 5 plates. [Received 3rd April 1918.]

This bulletin discusses the life-history of several beneficial Syrphids, all of which in the larval stage feed on Aphids.

The species dealt with are *Xanthogramma divisa,* Will., larvae of which were collected from choke cherry (*Prunus virginiana*) among *Aphis cerasifoliae,* Fitch, from *Cornus* sp., feeding on *A. cornifoliae,* Fitch. from poplar, among *Chaitophorus populicola,* Thom., and from willow infested with *Pterocomma smithiae,* Mor.; *Syrphus oronoensis*

sp. n., an important predator on the Aphids affecting stone fruits, the larvae having been taken on a willow infested with *Pterocomma smithiae* Mor., on cultivated cherry among *Myzus cerasi*, F., and on cultivated plum among *Phorodon humuli*, Schrank, and *Rhopalosiphum nymphaeae*, L.; *Platychirus perpallidus*, Verr., a British species, not hitherto recorded from America, and much commoner in Maine than *P. quadratus*, Say, to which it is closely allied; and *Syrphus knabi*, Shann., formerly recorded as *S. xanthostomus*, Will., reared in Maine from the pseudo-galls formed on ash leaves by *Prociphilus fraxinifolii*, Fitch.

SEVERIN (H. H. P.). **Life-History, Habits, Natural Enemies and Methods of Control of the Currant Fruit Fly (*Epochra canadensis*, Loew).**—*Maine Agric. Expt. Sta., Orono*, Bull. no. 264, September 1917, pp. 177–247, 5 plates. [Received 3rd April 1918.]

This bulletin deals at length with the Trypetid, *Epochra canadensis*, Lw. (currant fruit fly). A list of 16 popular names applied to this insect is given. No parasitic natural enemies seem to exist, though several species of spiders prey upon the adult flies, which have been also attacked under laboratory conditions by a fungus.

No satisfactory method of control appears to be known, though coal and wood ashes placed upon the soil under currant and gooseberry bushes has prevented the emergence of flies from it. Fowls allowed to run under the bushes destroy many pupae, but at the same time expose and damage the roots. Deferring the gathering of of the crop until August would ensure the fruits being free from maggots, but would risk the loss of some from sun scald. Spraying with lead arsenate or sodium arsenite and diluted molasses increases the yield of fruit on the treated bushes, but the first application should be made after the fruit is set, to avoid the poisoning of bees.

A bibliography of 62 works covering the period 1873–1916 is appended.

WOODS (W. C.). **The Biology of the Alder Flea-beetle, *Altica bimarginata*, Say.**—*Maine Agric. Expt. Sta., Orono*, Bull. no. 265, October 1917, pp. 249–284, 22 figs. [Received 3rd April 1918.]

The Chrysomelid, *Haltica bimarginata* (alder flea-beetle), is of no great economic importance, though it occurs in enormous numbers more or less periodically. In the State of Maine an outbreak occurred from 1912–1915, the maximum abundance being in 1914. The infestation was so severe that many trees were killed in a single season.

The only other known food-plant of this insect is a willow, *Salix rostrata*, but a biological race occurs in Maine living on balsam poplar.

The chief natural enemies are a Tachinid, *Hyalomyodes triangularis*, Lw. (*weedi*, Town.), the larva of which is an internal parasite of the adult beetle, and the fungus, *Sporotrichum globuliferum*, to the attacks of which larvae, pupae and adults are very susceptible.

Should artificial control be necessary, a thorough spraying with lead arsenate at the rate of 3 lb. paste to 50 U.S. gals. water as soon

as the beetles appear in spring, and repeated, if necessary, in late June and mid-July for the larvae, should prove efficacious.

The bulletin concludes with a discussion of the validity of the name *Haltica*, pointing out that *Altica* Geoffroy (1762) was emended to *Haltica* by Illiger (1802), the author being of opinion that this is inadmissable. [In the work by Geoffroy referred to the binomial system was not adopted and therefore the generic names there used are invalid.—ED.]

PATCH (E. M.). **The Aphid of Choke Cherry and Grain,** *Aphis pseudoavenae*, **sp. n.**—*Maine Agric. Expt. Sta., Orono*, Bull. no. 267, November 1917, pp. 293–296, 1 fig. [Received 3rd April 1918.]

The new Aphid here described under the name *A. pseudoavenae* in mounted material can only with difficulty be separated from the *A. avenae* of American authors, though in life it is distinguished by the absence of the dark green longitudinal lines characteristic of that species and by the presence of conspicuous areas of wax powder, especially in the spring generations. The spring generations live on choke cherry (*Prunus virginiana*), and examples collected on 25th June showed that both apterous and alate viviparous females were present, and migrants were already taking wing. These accepted experimentally the following alternative host-plants:—Timothy grass, Kentucky blue grass, sheep fescue, meadow fescue, red top, barley and oats.

CHILDS (L.). **The Life-History and Control of the Rose Leaf-hopper, an Apple Pest.**—*Oregon Agric. Coll. Expt. Sta., Corvallis*, Bull. no. 148, February 1918, 32 pp., 10 figs., 1 plate.

The greater part of the subject matter of this bulletin dealing with *Empoa rosae* as a pest of apple foliage has already been noticed [see this *Review*, Ser. A, iii, p. 270]. The rose leaf-hopper does not suffer to any great extent from the attack of predaceous and parasitic enemies, the chief being the Chalcid, *Anagrus armatus*, which has been found to parasitise fully one-third of the eggs. Predaceous insects destroying the nymphs are *Chrysopa californica* (green lacewing), *Hemerobius pacificus* (brown lace-wing), *Triphleps* sp., and the larva of a predaceous thrips, while the adults are sometimes destroyed by the fly, *Scatophaga merdaria*, and several species of spiders.

Control may be effected by the use of the rose as a trap-crop, 92·7 per cent. of over-wintering eggs being deposited in rose stems, when a choice of host-plants has been possible. Infestation of apple orchards may be prevented by the pruning and spraying of rose bushes in their vicinity before the insects become winged. The first generation in apple orchards can be controlled by the use of lime-sulphur in the ten-day and thirty-day scab sprays, and after this period, Black Leaf 40, 1 in 1200, with 5 lb. soap to 100 U.S. gals. water has been found satisfactory. On roses, insects in the first three stages may be destroyed by Black Leaf 40, 1 in 2000, with 5 lb. soap to 100 U.S. gals. water, the strength being increased to 1 in 1200 against the later stages. All the sprays must be directed upwards, as the insects are confined to the under-surface of the leaves.

McColloch (J. W.) & Salmon (S. C.). **Relation of Kinds and Varieties of Grain to Hessian-fly Injury.**—*Jl. Agric. Research, Washington, D.C.*, xii, no. 8, 25th February 1918, pp. 519–527.

In view of the contention that certain varieties of grain (*Triticum* spp.) are immune to the attacks of *Mayetiola destructor* (Hessian fly), experiments have been outlined to determine the relative infestation and injury of different varieties of small grain, and also to determine why certain kinds and varieties are resistant or immune; or, if not, why they escape injury in some cases where others are badly injured.

From the consideration of 87 kinds of varieties of wheat (*Triticum* spp.), oats (*Avena sativa*), barley (*Hordeum* spp.), and rye (*Secale cereale*), it was concluded that the Hessian fly is able to distinguish between different kinds and varieties of grain. It was found that eggs were laid on all the kinds and varieties of grain studied, but very sparingly on winter oats, winter barley and on three varieties of *Triticum*; that, on the average, fewer eggs were laid on soft winter wheat than on hard red winter wheat, though exceptions occurred in both cases. There appeared to be a high mortality of eggs or larvae on all kinds and varieties studied, heing greatest for rye, winter oats and three varieties of *Triticum*.

Fagan (M. M.). **The Uses of Insect Galls.**—*American Naturalist, Lancaster, Pa.*, lii, no. 614, February-March 1918, pp. 155–176.

This paper deals with the history of the uses of various galls, analyses of some of the more important being given.

Those used in medicine include galls of *Andricus fecundatrix*, Hart., *Cynips polycera*, Giraud, *C. gallae-tinctoriae*, Ol., *C. quercus-folii*, L., *C. quercus-tozae*, Bosc., *Pemphigus cornicularis*, *P. pallidus*, *Rhodites rosae*, L., *Schlechtendalia chinensis*, Bell, besides undetermined ones such as: Chinese oak gall, Istrian gall and Marmora gall.

In the manufacture of ink the galls used are those of: *Cynips gallae-tinctoriae*, Ol., *C. kollari*, Hart., *Schlechtendalia chinensis*, Bell, and many undetermined ones.

For tanning the following have been used: *Cynips gallae-tinctoriae*, Ol., *C. hungarica*, Hart., *C. insana*, Westw., *C. kollari*, Hart., *C. lignicola*, Hart., *C. quercus calycis*, Burgsdorf, and *Schlechtendalia chinensis*.

Galls used in dyeing include those of: *Cynips gallae-tinctoriae*, *C. insana*, *C. kollari*, *C. quercus-calycis*, *C. quercus-petioli*, *Pemphigus cornicularis*, *Schlechtendalia chinensis*, possibly *Chermes* sp., and many undetermined ones.

As food, only a few galls have been used, including those of: *Aulax glechomae*, *Cynips* spp., *Discholcaspis weldi*, *Callithytis* sp., *Chermes* sp., and *Schlechtendalia chinensis*.

As fuel for lamps the Greeks used galls of *Cynips theophrastea*.

An alphabetically-arranged list of common names of insect galls, and a bibliography of sixty-five works are appended.

Tothill (J. D.). **The Predaceous Mite, *Hemisarcoptes malus*, Shimer, and its Relation to the Natural Control of the Oyster-shell Scale, *Lepidosaphes ulmi*, L.**—*Agric. Gaz. Canada, Ottawa*, v, no. 3, March 1918, pp. 234–239, 3 figs.

The mite, *Hemisarcoptes malus*, is the most important single factor

in the natural control of the oyster-shell scale, *Lepidosaphes ulmi*, upon the newly deposited eggs of which it preys. This mite is widely distributed in orchards throughout large districts, probably through the medium of birds and tree-visiting animals. As yet, *H. malus* has been recorded as feeding only on *L. ulmi* and *Aspidiotus perniciosus* (San José scale), and though Europe seems to have been its original home, the extent to which it has followed *L. ulmi* in its now almost world-wide distribution remains to be determined.

In Canada, as in France, the mite is able to hibernate in any or all of its stages, and to maintain its activity at comparatively low temperatures, which accounts to a great extent for its usefulness. In places where the host is only fairly abundant, the mite becomes proportionately less efficient. Though chiefly a predator on the eggs, it has been recorded from both France and New Brunswick as feeding in summer time upon the growing, and even full-grown scales.

JARVIS (E.). **Parasites of the Cane Beetle.**—*Queensland Agric. Jl., Brisbane*, vii, no. 6, June 1917, pp. 293-294. [Received 8th April 1918.]

A new Tachinid was bred in January 1917 from a specimen of *Lepidiota albohirta*, which was infested by a single maggot of this fly. It was able however to mature and deposit fourteen eggs before succumbing.

The eggs of the parasite are deposited upon the body of the host, being firmly attached so as to render removal difficult. The young larvae on hatching bore into the host, often preventing oviposition by entirely destroying the ovaries. The adult beetle is very liable to attack by Dipterous parasites, owing to its habit of remaining on its food-plant all day in a motionless or semi-torpid state. The eggs of this Tachinid are in their turn probably subject to attack by Proctotrupid parasites that check its increase.

Another abundant, but unidentified species of Tachinid has also been bred from the adult of *L. albohirta*, the number of larvae from a single beetle varying from 3 to 12 .

From about eight species of root-eating Scarabeid larvae affecting cane, four Asilid and eight Dexiid parasites have been bred during the last two years, but these are not of great economic value as they are too vigorously controlled by insect and other enemies. In addition to these, cane-infesting Scarabeid larvae are preyed upon by at least one species of Elaterid larva and by three Scoliids, which however are hyperparasitised by Bombyliids and Mordellids.

ILLINGWORTH (J. F.) & JARVIS (E.). **Cane Grub Investigation.**—*Queensland Agric. Jl., Brisbane*, ix, no. 1, January 1918, pp. 24–26.

The grass-feeding species of cane beetle, *Lepidiota frenchi*, was held in check during 1917 by the use of arsenic and of carbon bisulphide, equally good results being obtained in both cases, while the cost of the arsenic was considerably less.

Experiments have shown that this beetle is also parasitised by the green Muscardine fungus [*Metarrhizium anisopliae*], the development of which proceeds best at a temperature not above 70° F.

A species of *Micrococcus* that attacks white grubs in America and the development of which is favoured by excessive moisture, might prove beneficial if introduced into Queensland against *L. albohirta*.

The life-history of *Campsomeris radula*, F., a Scoliid wasp that preys on several kinds of cane beetles, is being successfully worked out.

BECKER (G. G.). **Control of Insects affecting Stored Seed and Food Products.**—*Univ. Arkansas Agric. Expt. Sta., Fayetteville*, Circ. no. 33, 1918, 8 pp., 1 plate, 2 figs. [Received 9th April 1918.]

This circular suggests practical and economical methods of preventing to a large extent the losses caused to stored seed and food products by weevils and other insects, including *Sitotroga cerealella* (Angoumois grain moth), *Plodia interpunctella* (Indian meal moth), *Tenebrio obscurus* (meal worm), *Calandra oryzae* (rice weevil), *Silvanus surinamensis* (saw-toothed grain beetle), *Bruchus quadrimaculatus* (bean weevil), etc. The recommendations given are based upon the investigations of Dr. W. E. Hinds, which have been previously noticed [see this *Review*, Ser. A, ii, p. 382]. Particulars regarding carbon bisulphide fumigation are given and Dr. Hinds' apparatus is described [see this *Review*, Ser. A, iii, p. 685].

BECKER (G. G.). **The Dormant Spray for the San José Scale.**—*Univ. Arkansas Agric. Expt. Sta., Fayetteville*, Bull. no. 141, January 1918, 11 pp.

This bulletin reviews the various lime-sulphur, miscible oil and kerosene or crude oil emulsions for the control of San José scale [*Aspidiotus perniciosus*], discussing their efficiency, effect on the trees, cost and convenience. Various formulae are given, with tables showing the cost of different materials. The times recommended for using the sprays are in autumn when the leaves have fallen, and during warm days in winter or in spring when the buds begin to swell, the latter appearing to be the most effective.

TAYLOR (T. H.). **Observations on the Habits of the Turnip Flea-Beetle.**—*Entomologist, London*, li, no. 659, April 1918, pp. 83-86.

Of the two species usually classed together as the turnip flea-beetle in the Leeds district, *Phyllotreta undulata* is always more abundant than *P. nemorum* and does far more damage. Both species hibernate in the adult stage and begin feeding again in May and June on horse-radish and charlock. Oviposition takes place during June, July and the first part of August, after which the adults die off, none surviving the autumn. The new brood appears in July, August and September and feeds, chiefly on the turnip, till the weather turns cold, when the beetles begin to hibernate, mainly in crevices in the bark of trees. Before doing this, they have the habit of congregating in large numbers upon one or more of the plants where they have been feeding, producing the appearance of an unusual infestation.

The eggs of *P. nemorum* are laid on the moist soil and not on the host plant, and after about 9 days the larvae hatch out and, crawling up the leaves, burrow into them. The larval stage lasts for 25–30 days, the last 6 or 10 being spent by the larva in burying itself in the soil, preparatory to pupation. The pupal stage last for 7–17 days.

It is probable that the eggs of *P. undulata* are also laid in the ground near turnips and allied plants. They hatch in 6–11 days and the larvae begin feeding on the roots of various crucifers, spending the whole larval life of 18–30 days underground. Probably the numerical preponderance of this latter root-feeding species is due to its protection from Ichneumonids and other parasites, from the attacks of which *P. nemorum* suffers severely.

BAGNALL (R. S.) & HARRISON (J. W. H.). **New and Rare British Cecidomyidae. I.**—*Entomologist's Rec. & Jl. Var., London*, xxix, nos. 10–11, 15th October—15th November 1917, pp. 206–210 & 228–230; xxx, no. 4, 15th April 1918, pp. 67–68.

This family, which is a large one and of very diverse habits, includes *Phaenobremia* sp., the larvae of which have been reported from Durham feeding on *Aphis mali* on apple; *Endaphis* sp., a parasite of an Aphid on *Ononis repens*; *Dichodiplosis langeni*, Rübs., found on dried plums; *Rhabdophaga pseudococcus*, Rübs., plentiful on *Salix caprea*; *R. pulvini*, forming characteristic galls on *Salix aurita* and *S. vitellina*; *Perrisia panteli*, Kieff., on oak; and *Endaphis perfidus*, Kieff., a parasite of *Aphis platanoides* on sycamore.

GOLD (A. A.) & WHEELER (C. E.). **Handy Spray Calendar and General Information on Spraying Orchards and Gardens.**—*West Virginia Dept. Agric., Charleston*, Bull. no. 35, December 1917, 15 pp. [Received 11th April 1918.]

In this bulletin the methods of dealing with San José scale [*Aspidiotus perniciosus*] and other insect pests that have been increasing in the orchards and gardens of West Virginia are systematically and conveniently arranged; the treatment of the principal trees and plants are briefly described and reference is made to the proper remedies to be applied. It is hoped that by following the plans outlined the process of spraying may be greatly simplified.

PIERCE (W. D.). **How Insects affect the Cotton Plant and Means of Combating them.**—*U.S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 890, December 1917, 27 pp., 36 figs. [Received 15th April 1918.]

The principal pests of cotton are dealt with in this bulletin, the particular damage done by each being indicated. These include the cutworms, *Lycophotia* (*Peridroma*) *margaritosa* (variegated cutworm), *Laphygma frugiperda* (southern grass worm), and *Agrotis ypsilon*; the May beetles, *Lachnosterna* (*Phyllophaga*) *lanceolata* and *L. cribrosa*. Growth of the plant is checked by *Aphis gossypii*, Glov. (cotton aphis); the growing tip is damaged by *Chalcodermus aeneus*, Boh. (cowpea pod weevil); leaf injuries are caused by *Alabama argillacea* (cotton leafworm), the grasshoppers, *Melanoplus differentialis*, Thos., and *Brachystola magna*, Gir., *Tetranychus telarius*, L. (cotton red spider), *Atta texana*, Buckley (leaf-cutting ant), *Estigmene acraea*, Dru. (salt-marsh caterpillar), *Apantesis arge*, Dru., *Caradrina exigua*, Hbn. (beet army worm), *Hyphantria cunea*, Dru. (fall webworm) and *Hyperchiria io*, F. The squares, flowers and bulbs are damaged by *Anthonomus grandis* (Mexican cotton-boll weevil), *Heliothis* (*Chloridea*) *obsoleta*,

Hbn. (bollworm), the butterfly, *Uranotes melinus*, Hbn. (cotton square borer), *Prodenia ornithogalli*, Guén. (cotton-boll cutworm), and *Dysdercus suturellus* (cotton stainer). Bugs that attack the squares and bolls include *Adelphocoris rapidus*, Say, *Leptoglossus phyllopus*, L., *Largus succinctus*, L., *Nezara hilaris*, Say, and *Jadera haematoloma*, Schf. Flower beetles, which when numerous damage the blooms, include *Epicauta vittata*, F., *E. lemniscata*, F., *E. cinerea*, Forst., *E. ferruginea*, Say, etc. and *Chauliognathus* spp. (soldier beetles). Injuries to the stalk and roots are caused by wireworms, such as *Monocrepidius vespertinus*, F., *Horistonotus uhleri*, Horn, *Aphis maidiradicis*, Forbes (corn root aphis), *Papaipema nebris*, Guén. (*nitela*, Guén.) (moth stalk-borer), *Ataxia crypta* (cotton stalk-borer beetle), *Oecanthus niveus*, De G. (snowy tree cricket) and leafhoppers, including *Homalodisca triquetra*, F., *Oncometopia undata*, F., *O. lateralis*, F., and *Aulacizes irrorata*, F. Ants in the cotton field may be either beneficial or injurious. Such large species as *Atta texana*, Buckley, and *Pogonomyrmex barbatus malefaciens*, Buckley, should be destroyed; but several of the smaller species of ants, particularly those of the genera *Solenopsis*, *Pheidole*, *Monomorium* and *Iridomyrmex*, are very efficient enemies of the boll weevil and are probably on the whole beneficial, although they encourage Aphids, whiteflies and scales.

A single system for cotton-insect control is described, the measures for each season being indicated. In early spring weeds should be kept down and poison-bait traps laid wherever necessary for cutworms, grasshoppers, May beetles, etc. Planting should be as early as possible, while avoiding frosts; prolific varieties that fruit rapidly should be chosen to suit the locality. For summer treatment, cultivation should be continued until the crop is gathered or as long as possible. With the first sign of attack by caterpillars plants should be dusted with powdered lead arsenate. In the autumn the cotton crop should be gathered without delay and then the plants destroyed by ploughing under or grazing as long before frost as possible. It is advisable to follow a three-year rotation with cotton following some crop other than maize. In winter all fence rows should be cleared, weeds cut and burnt, stubble fields ploughed and old stumps rooted up.

Gunn (D.). **The Small Cabbage Moth (*Plutella maculipennis*, Curtis).**—*Union S. Africa Dept. Agric., Pretoria*, Bull. no. 8, 1917, 10 pp., 8 figs. [Received 15th April 1918.]

Plutella maculipennis, Curtis (small cabbage moth) is a widespread pest of cabbage, cauliflower, stocks and other cruciferous plants in South Africa. The insect is entirely dependent upon meteorological conditions for its existence; in dry seasons it is abundant, but heavy rains destroy large quantities, and it is very sensitive to moisture. Eggs are laid on the leaves, usually on the upper surface near the veins, where they occur in clusters. In warm weather they hatch in about five days, the young larvae feeding upon the under-side of the leaf and soon dispersing all over the plant. A gauze-like web is spun over the spot on the leaf on which the larva is feeding, and here after 15 to 18 days the cocoon is made. The pupal stage occupies 5 to 7 days in summer and about 14 days in winter. It was previously thought that hibernation occurred in this stage, but this supposition

is certainly erroneous for the Transvaal. The adults are nocturnal and are attracted to lights, but do not fly far. Under natural conditions the adult life is short. Ten generations of the insect were reared in a few days over a year in insectary cages at the same temperature as in the open. Infested cabbages are constantly sent by rail, and thus the insect is disseminated.

The principal predaceous enemy is a large green Mantid, *Sphodromantis gastrica*, which destroys many of the larvae. Unfortunately this does not appear until October, when much damage has already been done. An Ichneumonid parasite was reared from the pupae, but occurs in insignificant numbers. Another Hymenopterous parasite was observed to be very abundant in Cape Colony a few years ago.

Control in the larval stage is comparatively easy with an arsenical spray, to which 2 lb. resin should be added to every 50 U.S. gals. of spray in order to render the insecticide adhesive. Cabbage and cauliflower plants grown in seed beds that have become infested should be sprayed before they are planted in gardens or fields. For infestation after the heads have formed tobacco extract or tar water should be used. All old plants should be destroyed.

HUTSON (J. C.). **Report of a Visit to St. Vincent during November and December 1917. A Preliminary Report on Certain Plant Bugs connected with Cotton in St. Vincent.**—Colonial Office MS. [Received 2nd May 1918.]

This report, as indicated by its title, records preliminary observations on certain pests injurious to cotton in St. Vincent and the neighbouring islands of Bequia and Batawia. The results of the life-history experiments will be published separately at a later date.

Dysdercus delauneyi (cotton stainer) has been until recently by far the most serious insect pest of cotton in the West Indies. It lives during the period between the cotton seasons by breeding on the pods of the silk cotton tree (*Eriodendron anfractuosum*) and the John Bull tree (*Thespesia populnea*), and by the eradication of these wild food-plants the insect has been reduced to a negligible quantity as a pest of cotton in St. Vincent. A similar campaign is now being carried on in Bequia, where it is realised that the cotton crop will never be a good one until *D. delauneyi* is kept under control. In Batawia it has been found necessary to eradicate the wild okra (*Malachra capitata*) also. Suggestions for the control of *D. delauneyi* throughout the islands include a close season for cotton during April. By this means the insect would be deprived of cotton plants from March to July, since cotton planted in May does not flower before July. In conjunction with the eradication of wild food-plants the cotton stainer would thus be deprived of its main sources of food supply during a critical portion of the year. Traps of cotton seed, seed cotton or cotton seed meal should be used just before the cotton begins to flower, the insects attracted by these traps being killed with gasolene torches. Individuals of *D. delauneyi* should be collected in the field, the small numbers now occurring having made this measure practicable. All cotton seed and refuse should be cleared at frequent intervals from the neighbourhood of cotton houses or ginneries. The plants should be picked clean of all open bolls.

The reductiou of *D. delauneyi* to a position of minor importance has revealed the true status of other plant bugs injurious to cotton. Of these, *Nezara viridula* (green bug) is abundant in St. Vincent and probably throughout the West Indies. It has a wide range of food-plants, of which a list is given, and on many of which it breeds. It seems likely that this species is able to subsist on almost any of the cultivated vegetables in addition to many wild plants, hut shows a decided preference for Leguminosae. The position of this bug with regard to cotton is discussed [see following paper]. It is a dangerous practice to grow a leguminous catch-crop followed by cotton, as this attracts *N. viridula* during the early part of the season and the bug is likely to remain in the field throughout the cotton season. Maize might however be used as a catch-crop. The seasonal abundance of *N. viridula* is apparently controlled by two factors, namely, the supply of food and the efficiency of egg-parasites. It seems probable that these two factors can be so regulated by artificial means as to assist each other much more effectively than at present. But for the various minute Hymenoptera that parasitise the egg-masses of *N. viridula*, and are the only known enemies of this bug, the pest would be abundant in St. Vincent for about nine months in the year. Apparently the bugs almost die out during the normal dry period from March to May, but enough of them survive to start a new period of abundance about June, when they occur in sporadic outbursts in areas differing from year to year. This would seem to be owing to the uneven distribution of parasites. By September, the parasites have increased sufficiently to be effective, while the food supply has decreased. The pigeon-pea crop then enables *N. viridula* to increase again in some districts, only to decrease again as soon as this crop is over. Eggs of *N. viridula* are usually laid in masses on the under-side of leaves or on the pods of leguminous plants, and give rise to nymphs that undergo five moults before the adult stage is reached. The various stages are described and are differentiated from those of a similar bug, *Edessa meditabunda*.

Control measures for *N. viridula* include clean cultivation in cotton fields, and in particular the elimination of the weed, *Polanisia viscosa*, on which the earlier stages of the bug breed, transferring later to cotton, and returning as adults for oviposition on the weed. This weed is sufficient to maintain *N. viridula* throughout the year. The borders of cotton fields should be freed from miscellaneous weeds; a grass crop on the border is advisable. Leguminous crops should not be intercropped with cotton, as the bugs not only attack the cotton, but also infect the intercrops with the fungi of internal boll disease and later carry this infection to the cotton bolls. Egg-parasites of *N. viridula* should be encouraged; it frequently occurs that in collecting the eggs 100 per cent. of the parasitised ones are destroyed. These can be distinguished by their darker colour. A certain number of the parasites can be liberated in the fields where leguminous crops or cotton are grown, and if abundant in any district, can be transferred to other districts that need them. Individuals of *N. viridula* should be collected when possible and new infestations on pigeon peas from December to February should be checked.

Other cotton pests include *Leptoglossus balteatus* (leaf-footed tomato bug), which is a general feeder found on tomatoes and bonavist beans.

Eggs are laid in a single row along the twigs of plants and hatch in about two weeks, the nymphs spending most of their lives on the same spot on their food-plants. Very little injury to cotton has been observed from this species, though boll disease has been found following the punctures of the adults. A related species, *L. gonagra*, was also found on tomato and bonavist bean, but no injury by it to cotton has been observed. Females of *L. balteatus* lay small batches of eggs every few days, with the result that broods of all stages of the bugs are to be seen in the field. It seems probable that *Leptoglossus* spp. are attacked by egg-parasites; though none have been found, it is reasonable to suppose that they are checked by natural enemies as they would undoubtedly prove injurious to cotton, tomato and leguminous crops if allowed to increase undisturbed.

Phthia picta (red tomato bug), which greatly resembles species of *Leptoglossus* in appearance, has been found in St. Vincent on tomato, bonavist bean, and *Physalis* sp. *P. picta* is normally not sufficiently abundant to be considered a pest, but breeding experiments indicate that the bugs are capable of puncturing cotton bolls and infecting them with internal boll disease. In the event of a sudden increase in numbers, the young should be collected and destroyed.

Edessa meditabunda, like *Nezara viridula*, is a common bush bug in St. Vincent, the two species being collectively known as pea chinks in Barbados. *E. meditabunda* has a wide range of food-plants, including nearly all those of *N. viridula*. As a pest of cotton it is almost negligible, since the adults hardly pierce the outer covering of the bolls and do not infect them with disease. Eggs are laid on the underside of leaves of such plants as *Polanisia viscosa*, tomato and various legumes, and on the inner side of the bracts of cotton. There are two egg-parasites of this species, one of them being the same or closely related to that infesting *N. viridula*. Control measures include the collection of adults, particularly at the time when they may be found swarming and mating on certain plants such as pigeon peas, *Tephrosia* spp., *Indigofera* spp., etc., and the encouragement and distribution of parasites.

Other plant bugs observed in St. Vincent, many of which have been found attacking cotton in the southern United States and other countries and must therefore be regarded with suspicion by cotton growers, include the Coreid, *Acanthocerus lobatus*, and an unidentified species; the orange variety of the Lygaeid, *Oncopeltus fasciatus*; the Pentatomids, *Thyanta perditor*, *Arvelius albopunctatus*, *Piezodorus guildingi*, and *Euschistus crenator*; and the Scutellerid, *Sphyrocoris obliquus*.

NOWELL (W.). **Mycologist's Report on a Visit to St. Vincent, October 17—December 9, 1917.**—Colonial Office MS. [Received 2nd May 1918.]

In this report the diseases of cotton are dealt with, and in particular the action of insects in encouraging the dissemination of infection. The damage done to cotton by the insects known as bush bugs, of which *Edessa meditabunda* (pea chink) and *Nezara viridula* (green bug) are the commonest, are described in detail. It is probable that *N. viridula*, the favourite food-plants of which are Leguminosae, is

the chief factor in conveying cotton boll disease from these plants to cotton, where it is spread from plant to plant by the cotton stainers (*Dysdercus*). Experiments show that both *N. viridula* and the tomato bugs, *Leptoglossus* and *Phthia*, are capable of carrying infection in this way. Washing the bolls with weak corrosive sublimate solution, which, when tried in the previous year, seemed to act as a deterrent, on this occasion had negative results.

Where an ample supply of their favourite food-plant is maintained, bush bugs may be present in considerable numbers close to cotton plants without injuring them, cotton heing apparently low in the scale of their preferred foods. The presence of *Dysdercus* is much more to be feared than that of bush bugs, because of the fluctuating effects of the latter as compared with the steady and rapid increase of injury due to the former up to the end of the season. As the effect of severe direct injury is to destroy or prevent the development of the lint, the amount of direct injury represented in the return of stained lint is small in comparison with that due to the internal and bacterial boll diseases.

Injury by these bugs to pea and bean crops was in some cases severe enough to threaten complete failure of the crop. The damage is in many cases increased by infection with the fungi of internal boll disease, which must now be included among the organisms causing disease in leguminous crops. There is in these plants however no spread of disease from seed to seed by contact as in the cotton boll.

DE ONG (E. R.). **Control of Red Spider.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, vii, no. 3, March 1918, pp. 112–120, 3 figs.

The term red spider is applied to three species of mites in California, namely, *Bryobia pratensis, Tetranychus mytilaspidis* (citrus red spider) and *T. telarius* (*bimaculatus, sexmaculatus*). *T. telarius* is the species of the greatest economic importance in the State, the chief cultivated plants that suffer severely from its attacks being stone fruits, particularly almond, prune and peach, English walnut, hops, heans, pumpkin and squash. The damage is mostly done from July to September, though garden beans are sometimes infested until the November frosts. Through the winter months the mites subsist upon geranium, violet and other hardy winter plants. It is prohable that females may oviposit during warm days in winter, but the nymphs hatching from these eggs are usually killed by a sudden fall in temperature and it is not until late spring that any numbers appear, eggs then hatching in 3 to 6 days, and the development to the adult form requiring 12 to 18 days in hot weather. The hibernation period has not been closely investigated in California, but in all probability some of the mites remain on winter food-plants such as wild blackberry, geranium, sowthistle (*Sonchus*), *Chenopodium botrys*, violets, hollyhocks, mustard and privet, while others hibernate in the ground at the base of the trees attacked.

Mites are largely disseminated by wind, a moderate wind carrying them as far as 400 or 500 feet, and also hy travelling from plant to plant when the leaves are touching and by crawling over the ground. Female mites are able to crawl several feet an hour over cultivated

ground, travelling more rapidly at high temperatures than low. Such preventive measures as checking the mites on their winter host-plants, reducing wind dispersion, and natural control by climatic conditions and predatory animals are insufficient. The use of sulphur is therefore recommended, either in powder or dissolved form. The methods of applying these two forms are discussed and compared. A powder sprayer is advised as being more economical and effectual than hand machines. The sulphur treatment should be given during the first week in July, irrespective of weather or presence of the mites. The same treatment should be given for *Bryobia pratensis*, found in the coast districts of California, but only at temperatures from 70 to 100° F. when sulphur will volatilise readily. The winter is passed by this mite in the egg-stage on the tree that serves as a food-plant. Winter treatment of the eggs has given variable results, a 12½ to 15 per cent. oil emulsion being as satisfactory as any.

MASKEW (F.). **Quarantine Division. Report for the Month of November, 1917.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento,* vi, no. 3, March 1918, pp. 168–169.

The following pests were intercepted:—From Samoa: *Eulecanium* sp. on *Hibiscus.* From Central America: *Aspidiotus cyanophylli* and *Selenaspidus articulatus* on bananas. From China: Weevil larvae in sweet potatoes. From Hawaii: *Diaspis bromeliae* on pineapples; *Pseudococcus bromeliae* on pineapples and bananas; weevil larvae in sweet potatoes and seed pods; *Chrysomphalus aonidum* and *Pseudococcus* sp. on green coconuts; *Coccus longulus* on betel leaves. From Holland; *Eumerus strigatus* in bulbs. From Isle of Pines: *Lepidosaphes beckii, Parlatoria pergandii,* and *Chrysomphalus aonidum* on grapefruit. From Japan: Lepidopterous larvae in dried persimmons; *Poliaspis pini* on pot plants. From Idaho: Tetranychids on apples. From Mexico: Lepidopterous larvae in dates. From Nevada: *Rhizoctonia* and eelworm in potatoes. From Ohio: Weevils in chestnuts and *Coccus hesperidum* on crotons. From Oregon: *Rhizoctonia* on potatoes; *Venturia inaequalis* on apples. From Tennessee: Unidentified larvae in chestnuts. From Louisiana: *Saissetia oleae* on bananas. From Washington: *Venturia pyrina* on pears; eggs of Tetranychids, *Cydia pomonella* and *Leptothyrium pomi* on apples; *Rhizoctonia* and *Heterodera radicicola* on potatoes.

MOORE (W.) & GRAHAM (S. A.). **Toxicity of Volatile Organic Compounds to Insect Eggs.**—*Jl. Agric. Research, Washington, D.C.,* xii, no. 9, 4th March 1918, pp. 579–587.

The studies recorded in this paper were undertaken in view of the work of the senior author showing that the toxicity of organic compounds to insects is related to their volatility, of which the boiling point is a general index [see this *Review,* Ser. B, v, pp. 131 and 174.]. The eggs chosen for the experiments were those of the potato beetle, *Leptinotarsa decemlineata,* Say, of which 100 per cent. of untreated eggs hatched. Various chemicals were used, their effects being studied by dipping the egg-clusters in the chemical to be tested, by spraying the clusters with an atomizer and by exposing the eggs to

the action of the vapour of the chemical. In the last case, the eggs were fumigated for 15 hours. The results of these various experiments and the different materials used are given in a series of tables. The results of the dipping and spraying experiments showed in general that eggs treated with compounds having the lowest boiling point, that is, the most volatile compounds permitted most, if not all, of the eggs to hatch, except in the case of compounds extremely active chemically, such as allyl alcohol, which contained ammonia, and chlorpicrin. Spraying resulted in a higher percentage of hatching than dipping. Some compounds, the vapour of which had proved non-toxic to house-flies, were found to be toxic to the insect eggs; such were pinene, terpineol, and geranyl acetate. Others, that are so slightly volatile that they are ineffective against flies, were found to be toxic to the insect eggs; these included eugenol, alpha naphthol, ethyl ether, and trimethylene cyanide. As fumigants, these are ineffective.

Compounds with low boiling points kill freshly laid eggs more readily than those in which the embryo is partly or fully developed. Compounds with higher boiling points are more toxic to eggs with fully developed embryos than they are to eggs in which the embryo is only slightly formed. Kerosene containing both high and low boiling points is destructive to both young and old, but is only slightly toxic to partly developed eggs.

Fumigation in a saturated atmosphere with ether, ethyl mercaptan, carbon bisulphide, benzene, carbon tetrachloride and chloroform will kill all the eggs in one hour.

The toxicity of the vapour of organic compounds to insect eggs is related to the boiling point and the volatility. As the boiling point increases and the volatility decreases, the toxicity increases.

PIERCE (W. D.). **Weevils which affect Irish Potato, Sweet Potato and Yam.**—*Jl. Agric. Research, Washington, D.C.*, xii, no. 9, 4th March 1918, pp. 601–611, 7 plates.

The potato, which is a native of the west coast of South America, has a series of characteristic weevil enemies, three of which have been described in a previous paper [see this *Review*, Ser. A, ii, p. 241]. In this paper a key to the various species is given, and *Trypopremnon sanfordi*, sp. n., is described from a single specimen from Peru, intercepted in quarantine on a potato tuber.

Weevils that attack sweet potato tubers include *Euscepes batatae*, Waterh., *Cylas formicarius*, F., *C. turcipennis*, Boh., and *C. femoralis*, Faust. A key to some of the species of the genus *Cylas* is given. *E. batatae* is one of the most serious pests of the sweet potato. It has hitherto been recorded from many parts of the West Indian Islands and the known distribution now includes Brazil, Jamaica, Hawaii, Guam, New Zealand and Porto Rico. It probably occurs in many other countries, and strict quarantine should be observed against its introduction. Drawings and descriptions are given differentiating the immature stages from those of *Cylas formicarius*.

Palaeopus dioscoreae, sp. n., a weevil that attacks the tubers of yams, is described from two individuals reared from tubers of *Dioscorea batatas* from Jamaica.

Gibson (A.). **Cutworms, Root Maggots, White Grubs and Locusts, and their Control.**—*Canada Dept. Agric., Ottawa,* Crop Protection Leaflets nos. 3, 4, 5 & 6, February 1918, 14 pp., 7 figs. [Received 16th April, 1918.]

The injury done by cutworms is described and remedial measures are suggested [see this *Review,* Ser. A, ii, pp. 24, 521, iii, p. 564, 620]. The root maggots dealt with include *Phorbia brassicae* (cabbage root maggot), *Hylemyia antiqua,* Mg. (imported onion maggot), and *Phorbia fusciceps,* Zett. (seed-corn maggot); the information given has already been dealt with and includes a description of tarred felt discs [see this *Review,* Ser. A, iv, p. 347], and of the sodium arsenite bait spray [see this *Review,* Ser. A, vi, p. 122].

White grubs [*Lachnosterna*] threaten to be very troublesome in 1918 in Canada, owing to the abundance of adult beetles that oviposited in 1917 [see this *Review,* Ser. A, v, p. 447]. As the eggs are laid in sod land or in land bearing such crops as timothy and small grains, it will be unsafe in 1918 to plant on any land where the beetles occurred in the previous year, except such crops as lucerne, clover or buckwheat. Potatoes, maize and strawberries are particularly favoured by the beetles. Ploughing in late summer brings many grubs to the surface, where they are crushed or die from exposure. Infested land might be ploughed in early spring, thoroughly harrowed and planted with a late crop. This will attract grub-feeding birds. Domestic fowls will clear infested fields of many grubs if allowed in them during ploughing. Pigs are also useful in this way [see this *Review,* Ser. A, v, p. 206].

The usual methods of control for locusts are described [see this *Review,* Ser. A, v, pp. 241 and 382].

Ross (W. A.). **Aphids or Plant Lice.**—*Canada Dept. Agric., Ottawa,* Crop Protection Leaflet no. 8, [n. d.], 2 pp., 1 fig. [Received 16th April 1918.]

This leaflet gives a few general notes on Aphids, with brief directions for their control in greenhouses, gardens and in the field.

Gibson (A.). **The Parsnip Webworm.**—*Canadian Horticulturist, Toronto,* xli, no. 3, March 1918, p. 52.

Depressaria heracleana (parsnip webworm), which has been troublesome in Canada for the past two years, is a difficult pest to control, and experimental work in this connection is still being carried on. Mixtures of powdered sulphur and powdered lead arsenate, dusted over the plants where the caterpillars are present, have given the best results. Spraying with lead arsenate and Paris green has not been successful.

Leopold (—). **Commercial Dusting in a Quebec Orchard.**—*Canadian Horticulturist, Toronto,* xli, no. 3, March 1918, pp. 49–50.

Caesar (L.). **Economical Sprays and Spraying for 1918.**—*Ibid.,* pp. 51–52.

Parrott (P. J.). **War-Time Spraying Problems.**—*Ibid.,* pp. 53–54.

Sanders (G. E.). **Nova Scotian Results with Arsenate of Lime.**—*Ibid.*, p. 54.

Carpenter (F.). **Spraying the Apple Orchard.**—*Ibid.*, p. 55.

In these papers general recommendations for spraying are given, the best materials to use are discussed, and some account is given of both dusting and liquid spraying.

Silvestri (F.). **Gli Insetti africani contro la Mosca olearia.** [The Use of African Insects against the Olive Fly.]—Separate from *Boll. Soc. Nazionale Olivicoltori, Rome,* xii, no. 1–2, January-February 1918, pp. 16–18. [Received 2nd April 1918.]

As a result of an agreement between the Italian Ministry of the Colonies and the National Society of Olive Growers a collection of *Opius concolor*, the parasite of the olive fly [*Dacus oleae*], has been made in Tripoli. Some of the specimens were reserved for breeding in the laboratory at Portici, whilst 3,260 individuals were released between October 1917 and February 1918. It is hoped to effect a similar collection this year.

Moreira (C.). **Insectos nocivos.** [Injurious Insects.]—*Chacaras e Quintaes, S. Paulo,* xvii, no. 2, 15th February 1918, pp. 93–94.

Though not so utilised at present, the Urticaceous plants of the genus *Cecropia* possess considerable potential value for paper-making. Their chief enemy is a Chrysomelid beetle, *Coelomera lanio*, Dalm., *Cecropia cinerea* being the species which is chiefly attacked. The eggs of *C. lanio* are laid in masses of about 100 attached to the underside of the leaf. The larvae remain in groups and feed on the undersurface until the leaf is skeletonised.

The ornamental tree, *Pachira aquatica*, is attacked by the Longicorn, *Dryoctenes scrupulosus*, Germ., the larva of which bores into the trunk in all directions.

Moreira (C.). **Uma Praga das Plantações.** [A Pest of Plantations.]—*Chacaras e Quintaes, S. Paulo,* xvii, no. 2, 15th February 1918, p. 123.

Great injury to gardens and potato fields by the Meloid beetle, *Epicauta atomaria*, Germ., is reported. Spraying with arsenicals provides a remedy, but where only a few plants are attacked, hand collection is preferable.

Murania (G.). **Verme delle Mele e delle Pere** (*Carpocapsa pomonella*, **L.**). [The Apple and Pear Worm, *Cydia pomonella*.]—*Il Rinnovamento Economico-Agrario, Trapani,* xii, no. 2, February 1918, pp. 25–27.

This article deals with the usual remedial measures against *Cydia pomonella*, which causes the loss of 70 per cent. of the apple and pear crop in the province of Trapani, Sicily.

Sammlung und Verwertung der Maikäfer. [The Collection and Utilisation of *Melolontha melolontha.*]—*Schweiz. Zeitschr. Obst- u. Weinbau, Frauenfeld,* xxvii, no. 7, 6th April 1918, pp. 108–109.

An order of the Swiss Department of National Economy, dated 25th March, requires all communes, where a flight of *Melolontha melolontha* is expected in 1918, to collect, kill and utilise these beetles. Special emphasis is laid on this last point as these insects form a valuable cattle food.

CRIDDLE (N.). **Popular and Practical Entomology. Light Traps as a Means of Controlling Insect Pests.**—*Canadian Entomologist, London, Ont.,* l, no. 3, March 1918, pp. 73–76.

Within recent years a good deal of attention has been paid to the question of the use of light-traps as a means of controlling certain insect pests. This practice is, however, not nearly so efficacious in destroying moths and beetles as it would appear to be. Insects are attracted to bright light only in comparatively limited numbers even under the most favourable weather conditions, the several essential factors, such as warmth and cloudiness, absence of moonlight and a stormy atmosphere with preferably a light rain falling, very seldom occurring in combination. A more important consideration is that the proportion of males secured in this manner is always far in excess of the proportion of females. A table of collections made during August and September for the past three years illustrates this. The proportion of Hymenopterous parasites taken at the lights must also be considered. It is certain that at least some of the female moths captured will have already deposited a proportion of their eggs. It is therefore considered that, at present at least, light-traps are not a practical method of controlling insect pests.

GILLETTE (C. P.) & BRAGG (L. C.). *Aphis saliceti* **(Kaltenbach),** *Siphocoryne pastinacae* **(Linn.), and allied Species.** *Canadian Entomologist, London, Ont.,* l, no. 3, March 1918, pp. 89–94, 1 plate.

The object of this paper is to clear away some confusion regarding several species of Aphids that are very similar in general appearance, and all but one of which have willows for their winter hosts. A key is given differentiating *Aphis theobaldi,* sp. n., *A. saliceti, Siphocoryne capreae, S. essigi,* sp. n., *S. pastinacae* and *S. grabhami.*

Aphis saliceti, Kalt., of which *Siphonophora salicicola,* Thomas, and *A. salicicola,* Monell, are synonyms, differs from other species mentioned in this paper in its habit of remaining upon willows throughout the year without apparently having an alternate summer host. It is also remarkable for the early appearance of sexual forms, these having been found as early as 20th June. *A. theobaldi,* sp. n., which has been erroneously recorded by Theobald as *A. saliceti,* Kalt., apparently alternates between willows and umbelliferous plants. *Siphocoryne essigi,* sp. n., was erroneously recorded by Essig in 1911 as *Hyadaphis pastinacae. S. pastinacae,* L., of which *Syphocoryne (Aphis) xylostei,* Schrank, is a synonym, has the European honeysuckle, *Lonicera xylosteum,* as its winter host.

ADKIN (B. W.). **The Practical Aspect of Forest Entomology. Part IV.** —*Qrtly. Jl. Forestry, London*, xii, no. 2, April 1918, pp. 80–98.

This paper deals with insects that are known to be highly injurious to coniferous woods and plantations in Britain. *Hylobius abietis* (large pine weevil) is considered the worst of these, and is very widespread, hardy and prolific. Hundreds of acres of pine and spruce are at present being felled, which it is desired to re-plant with young conifers. It is pointed out that if this is done while the old stumps are left in the ground without treatment, the weevils will breed freely in them and will devour the bark of the young trees. Suggestions are made regarding a change of crop until the stumps have decayed, but it is pointed out that this will not check the increase of the weevils, which will probably migrate elsewhere. Recommendations for treatment of the old stumps are given, the most successful being hot creosote, the cost working out at a little over ½d. per tree. Trapping the weevils, and encouraging the destruction of the larvae by means of the parasite *Bracon hylobii*, Ratz., are supplementary measures.

Myelophilus (*Hylurgus*) *piniperda* (pine beetle) is a dangerous pest, persistently boring the growing shoots of older pine trees so that in time they succumb. The chief methods of control are the elimination of breeding-places, or the provision of breeding-places as traps in which the beetles may be destroyed. This can be done by barking the logs, not later than May, and burning the bark.

Sawflies of larch and pine may cause great havoc by stripping the foliage of conifers. Pine-shoot moths include some ten species of the genus *Rhyacionia* (*Retinia*), such as *R. buoliana*, *R. pinicolana* and *R. turionana*, the larvae of which bore into the buds at the end of pine shoots, particularly on young trees. *Coleophora laricella* (larch mining moth) is found in many districts in Britain, the larvae boring into the needles in July and causing them to shrivel and turn white; here they pupate and the adults oviposit on the young shoots in the spring. *Blastotere* (*Argyresthia*) *atmoriella*, Bnks. (larch twig-boring moth), which was formerly erroneously recorded in England as *A. laevigatella*, H.S., attacks larch in many districts.

Various Aphids attack roots, foliage, buds, twigs, branches and stems of trees, sucking the juices and weakening them. Any nursery stock showing infestation with Aphids should be properly fumigated before planting out. Some conifers, such as Corsican pine, Sitka spruce and Japanese larch, are comparatively immune to Aphid attacks.

The general lines of procedure that are found most successful in preventing or checking the attacks of injurious insects include the destruction of all rubbish after felling, the elimination of breeding-places for those insects that pass their larval stage beneath the bark of stumps, felled trees, dead wood or sickly trees. Trees should be maintained in robust health and vigorous growth, so that insect attack may be avoided, or recovery after attack assured. Any assistance given by nature in this respect should be encouraged, such as protecting insectivorous birds in the woods and plantations, and rearing or importing parasitic enemies of the pests.

With regard to the first recommendation, this may be difficult to carry out while thousands of acres are being felled during the War, and while labour is scarce, and it is feared that insects that usually

do little damage in this country may find the unusual conditions after the War so favourable for their development as to cause losses to an unprecedented extent. The Forestry sub-committee has expressed the opinion that the Forest Authority should give early attention to this question and would do well to enforce orders for dealing effectively with insect pests. The importance of vigorous growth and the causes for weakly condition are discussed. Methods of improper treatment before planting are pointed out, and attention is called to the folly of using inferior seed, and particularly of cheap foreign nursery stock. The management of trees in general is discussed and the need for education and research in this subject is insisted upon. The committees that have reported on forestry in recent years have shown that they are aware of this need, and the author expresses the hope that the British Government will prove energetic in the encouragement of good forestry and generous in grants for research, experiment and education.

DUCHESNE (M. C.). **Preventive Measures against Pine Weevil Attack.** —*Qrtly. Jl. Forestry, London*, xii, no. 2, April 1918, pp. 135–140.

It has been suggested that, as a preventive of attacks of the pine weevil [*Hylobius abietis*], when old trees are felled the area should remain unplanted for at least four years until the old pine or spruce stumps should have rotted sufficiently to render the stumps unsuitable places for breeding. The author has been conducting experiments with a view to ascertaining to what extent it would be possible to reduce this long period, in view of the necessity for speedy re-planting and of the increased cost and very unfavourable conditions for re-afforestation at the end of that time. The plan adopted was to test methods of treating the stumps with a view to making unfavourable conditions for breeding and also destroying larvae in the stumps. Cresylic acid or sulphuric acid 1 : 50 or 1 : 75 is considered effective; creosote has been found beneficial in certain cases but is expensive; the difficulty is that all these substances are at present practically unobtainable. It is hoped that a cheap and effective substance may be found that could be placed on the stump and washed in by rain. The destruction of the larvae in the stumps depends mainly on the penetration of such an agent. The author considers it essential that when burning brushwood and the tops of Scots pine and spruce each stump should have a fire burnt on the top of it, and, whenever there are any young forest trees or a nursery within easy reach of the area, the stumps should be barked and the larvae destroyed. Details of this operation are described. It is suggested that, as a means of clearing up and burning brushwood, which is always an expensive item, brushwood might be heaped on the top of the stumps and a large fire started over the area to be cleared about the end of April or early May. It is hoped that these suggestions may lead to further investigations and experiment in the control of the pine weevil.

MACKIE (D. B.). *Oryctes rhinoceros* **in the Philippines.**—*Philippine Agric. Rev., Manila*, x, no. 4, 4th Quarter, 1917, pp. 315–334, 3 plates. [Received 22nd April 1918.]

Popular knowledge of the habits and bionomics of *Oryctes rhinoceros* (rhinoceros beetle) in the Philippines is apparently very limited and much erroneous and misleading information has been disseminated

on the subject. Inspection of over one million coconut palms showed 1·07 per cent. so badly damaged by the beetles that death was inevitable. The percentage of infestation was found to be fairly constant and the distribution general, neither altitude nor contiguity to the sea making any appreciable difference. Small holdings, where cultivation is not carefully practised, were naturally in the worst condition from beetle attack.

Eggs of *O. rhinoceros* are deposited for preference in dead coconut logs and stumps, under bagasse heaps, in manure heaps and in old rotten piles of coconut husks, where they hatch in 10 to 12 days. The young grubs at once begin to feed and remain in the larval state from 130 to 155 days, moulting four times. The pupal stage lasts from 30 to 37 days, when the adults emerge and at once begin their depredations. Up to this point their function has been entirely that of a scavenger. The beetles are very averse to light and hide in dark crevices or in the earth in the daytime, coming out into the open at night, when they are greatly attracted by light. Coconut is not the only plant damaged, *Corypha elata*, *Caryota urens* (fish-tail palm), *Oreodoxa regia* (West Indian royal palm), *Elaeis guineensis* (African oil-nut palm) and probably *Arenga saccharifera* (sugar palm) being attacked with equal avidity. The beetle, having reached a coconut palm, invariably selects a point near the base of the petiole of the central unexpanded leaves and works its way into the interior. As it works it feeds on the soft tissues by sucking their juices. As a burrow is cleared out, large quantities of fine fibre are discharged, which remain about the entrance and fall to the ground, indicating the presence of the beetle. The burrow often reaches a depth of about 12 inches. Coconut palms have only one central bud or growing point, and as this bud is in direct alignment with the beetle's tunnel it frequently happens that it is cut into and so injured that the bud dies. From the fact that the beetle requires only a few hours to enter and perhaps fatally injure a palm tree, the total extent of its depredations can be imagined.

When coconut trees are severely injured by the beetles, it is advisable to pull off all fruits and allow no flower-spikes to develop beyond the falling of the staminate blooms. The pistillate blossoms that resemble small nuts and are unfertilised can then be readily seen and removed. This will in many cases save the life of a tree that would otherwise succumb as a result of the added drain upon its vitality by reason of its effort to produce fruit when all its strength was needed to help its recovery from injury. It is probable that about 40 per cent. of the trees that die as a result of beetle attacks might be saved by this treatment. Beetles frequently pass from a wild plant to a cultivated one, and in the absence of cultivated plants they can sustain themselves on wild plants. In studying the life-history of this species it becomes obvious that the favourable environment that allows it to propagate and become such a pest is due almost entirely to the activities of man. Lack of clean cultivation, leaving piles of husks of coconuts in the plantations or heaps of bagasse have frequently been quite clearly shown to be the direct cause of outbreaks of *O. rhinoceros*.

Natural checks of the beetle have very little influence. Rats eat many of the grubs, domestic fowls and crows devour them when

exposed, and lizards may kill a few. Predators of the adults have practically no effect, as the beetles remain hidden during the day. A small mite occurs as an ecto-parasite on the larval, pupal and adult stages, but does not seem to affect development in any way.

Control measures for *O. rhinoceros* are difficult to evolve. Remedies against the adults are impracticable, as the injury is not apparent until too late to save the palm. The nocturnal habit of the beetles makes collection difficult. Poison is ineffective, as the beetle does not feed until the heart of the tree is reached. Banding or covering the trunks has not yet proved practical. On the other hand about 80 per cent. of the larvae can be found in refuse heaps and dead coconut logs, so that by gathering and burning these logs all immature beetles therein are killed, while adults are deprived of suitable breeding sites. As available breeding places are reduced, larger numbers of the beetle resort to those that are left and, applying this theory, it is found that compost pits constructed in suitable spots attract large numbers of beetles which oviposit therein. If these traps are cleaned out once every six months all immature stages of the beetle can easily be destroyed. Decayed stumps can be easily impregnated with a poison solution by boring holes into them with an augur and filling these holes with the solution. The water then evaporates allowing the poison to remain and killing anything that feeds on the poisoned wood. Fallen logs can be treated in the same way; 1 lb. sodium arsenate to 40 gals. water will kill *O. rhinoceros* in any stage, in from 4 to 36 hours.

In discussing the possibilities of an organised campaign against the beetle, and the necessity for co-operation, the author is strongly of opinion that to attain success the matter must be taken up under government supervision and conducted systematically by forces trained and familiar with the work. The loss sustained to coconut planters by trees killed is estimated at nearly £600,000, about 80 per cent. of which is preventable by simple control measures.

Kingman (F. C.). **Important Root Crops of the Philippines.**—*Philippine Agric. Rev., Manila,* x, no. 4, 4th Quarter, 1917, pp. 335–349, 5 plates.

The most injurious pest of sweet potatoes in the Philippines is *Cylas formicarius,* F. (sweet potato weevil), which deposits eggs in recesses at the base of the vine or at the upper end of the root. The maggots bore into the roots and when in sufficient numbers completely riddle the potatoes and destroy them. Pupation occurs in the root, whence the adults emerge to infest another crop. If the crop is dug early in the vicinity of Manila no serious damage is done. Control measures consist of early harvest, rotation of crops and the burning of all root refuse.

Lounsbury (C. P.). *Ceratitis cosyra* **and** *C. capitata,* **Diptera Injurious to Fruit Trees in South Africa.**—*Mthly. Bull. Agric. Intell. & Pl. Dis., Rome,* viii, no. 5, May 1917, pp. 816–817. [Abstract from *Agric. Jl. South Africa, Johannesburg,* iv, no. 24, December 1916, pp. 180–181, 1 plate.] [Received 24th April 1918.]

The fruit-flies, *Ceratitis rosae* (*cosyra*) and *C. capitata,* are responsible for nearly all the damage done to cultivated fruit trees in S. Africa, the

first being more common in Natal and the latter in the Cape Province. Both species occur in the Transvaal, where, however, *C. capitata* is usually much the more abundant. These pests are to a certain extent checked by predaceous insects, which destroy them as they fall to the ground preparatory to pupating in the soil.

Effective control can be exercised by the use of poison-bait, which consists of a light sprinkling of sugar water poisoned with lead arsenate. This should be applied early, and in the Transvaal needs to be repeated at short intervals, owing to the frequency of summer rains. Previous to the value of this remedy being proved, the only means of combating the pest lay in surrounding the fruit, or the whole tree with cotton netting, 20,000 yards, at a cost of about one penny a square yard, having been sold to fruit growers in 1898.

RABAUD (Et.). **Les Chenilles Parasitées de *Zygaena occitanica*, Vill.** [Parasitised Larvae of *Zygaena occitanica*, Vill.].—*Bull. Sci. France et Belgique, Paris,* l, 1916, no. 3, 10th February 1917, pp. 284–286.

It has been asserted that parasitised Lepidopterous larvae behave in a different manner from healthy ones, aimlessly leaving their natural habitat, or even pupating in situations peculiarly suited to their parasites. These statements seem to be based on the fact that all larvae before moulting or pupating cease to feed and either wander about on their own food-plant or even abandon it. The latter is the case with the larva of *Zygaena occitanica*, which, whether healthy or parasitised, always leaves its host-plant. Though the fact of its being parasitised may hasten these physiological changes, it certainly does not cause them.

From cocoons of *Z. occitanica* taken in a normal situation, the author has reared three Diptera: *Tricholyga major*, B.B., *Compsilura concinnata*, Mg., and *Blepharomyia pagana*, Mg., the same cocoon containing two or three pupae of the same or even different species; and three Hymenoptera:—*Atrometus insignis*, Först., *Monodontomerus dentipes*, Walk., and *Spilocryptus* sp.

CHAMBERLIN (W. J.). **Bark-beetles Infesting the Douglas Fir.**—*Oregon Agric. Expt. Sta., Corvallis,* Bull. no. 147, January 1918, 40 pp., 15 figs. [Received 5th April 1918.]

About 30 per cent., or 650 billion feet, of the standing coniferous timber in the United States is Douglas fir (*Pseudotsuga taxifolia*). Wherever commercial timber is grown in North America, it is the dominant tree and is undoubtedly destined to be the leading commercial tree of the future. The estimated annual loss to forests and forest products in the United States due to insects is approximately £20,000,000, and since Oregon contains one-fifth of the standing timber of the United States, the loss in that State is reckoned at approximately £4,000,000 annually. The present bulletin records the results of over two years' study of the life-histories and economic importance of the pests dealt with.

A key is given to the species of Scolytids concerned. These include *Cryphalus amabilis*, Chamb., which damages *Abies amabilis* and

Douglas fir. The eggs are deposited during the last week in August and hatch in 5 days, the larvae working in all directions and girdling the small limbs. Both sexes work at excavating the egg-chamber, each pair probably making more than one of these. *Dryocoetes pseudotsugae*, Swaine, is only known to attack Douglas fir, its distribution being along the Pacific coast from British Columbia to Northern California. The young adults hibernate in the bark. The galleries of this beetle are small and irregular. Adults, larvae and pupae were all found in August. The development of a brood is complete in 6 months. *Ips concinnus*, Mann., shows a preference for trees with thin bark. It does not often attack Douglas fir, but is very injurious to lodge-pole pine (*Pinus contorta latifolia*), and frequently attacks injured, dying or recently felled Monterey pine (*Pinus radiata*) and Sitka spruce (*Picea sitchensis*). *Pityophthorus nitidulus*, Mann., does considerable damage in the spruce regions of Colorado. A small central gallery is constructed under the bark, from which radiate three or four galleries. There are 3 or 4 females and one male in each chamber, each female depositing her eggs in a separate niche. The larvae construct radiating galleries in all directions and pupate in a cell almost wholly in the bark. When mature they eat their way directly to the surface.

Dendroctonus pseudotsugae, Hopk. (Douglas fir bark-beetle) attacks Douglas fir, big cone spruce (*Pseudotsuga macrocarpa*) and western larch (*Larix occidentalis*), but is evidently not strongly attracted to the latter species in Oregon. This species is found from British Columbia to Mexico, from the Pacific coast to the eastern slope of the Rocky Mountains and from sea-level to 8,000 feet. Hibernation occurs chiefly in the young adult stage, though some larvae are to be found practically all the year round. In early March or April the beetles extend their winter burrows or begin new ones, ovipositing as the gallery progresses. Incubation requires 8 to 10 days in the laboratory and probably about 16 days in the field. The young larvae eat their way out through the cambium and pupate after a period varying from 9 to 14 weeks. Broken logs, stumps and refuse are preferred for breeding. The adults enter crevices or holes in the bark and proceed to mine their way to the cambium. Here egg galleries are excavated and breeding continues. The larval mines are frequently longer than the main gallery and may cross and recross many times. When mature, the beetle burrows straight to the surface of the bark and so emerges. When badly attacked the foliage turns colour, or only part of the tree may fail, showing that the cambium has not been entirely girdled. *D. pseudotsugae* does not directly damage the timber, but causes a loosening of the bark and hastens the death of weakly trees. It is suggested that infested trees attacked during spring or summer should be barked or burned before the middle of August. The burning of any slashing that is infested before the beetles become active (1st April) will help to keep the pest in check. Two undetermined Ichneumonids have been reared from cocoons found in the mines of *D. pseudotsugae*. One of these is undoubtedly useful in keeping down the beetles, 10 or 15 per cent. of the pupal cells being occupied by its cocoons. *Seius safroi*, Ewing (mss.), a small mite found in numbers in the mines and pupal cells, *Bdella magna*, Ewing (mss.), and the nymphs and adults of a Gamasid mite

are probably predaceous on it. Both adults and larvae of the Clerid beetle *Clerus sphegeus*, F., feed upon all stages and are important enemies. *Cicindela longilabris*, Say (tiger beetle), an Asilid, *Dasyllis posticata*, Say, and an unidentified species doubtfully referred to the same genus, are all predatory on this beetle.

Tomicus (*Hylastes*) *nigrinus*, Mann. (red fir root borer) in the larval stage excavates long winding tunnels in the bark of the roots of Douglas fir. This species occurs from Alaska to California, but is not numerous or economically important. *Hylastes ruber*, Swaine, attacks dying or weakened Douglas fir. *Scolytus unispinosus*, Lec., attacks *Pseudotsuga taxifolia*, *P. mucronata*, *Larix occidentalis* and *Picea engelmanni*. The species from the two last-named trees may be a closely related beetle and not the true *S. unispinosus*. The latter which occurs in the Pacific coast and Rocky Mountain States and in south-western Canada, excavates two short straight longitudinal galleries from an entrance burrow in living bark of injured, dying or recently felled Douglas fir and western larch. From 40 to 100 eggs are deposited in crevices in the sides of the main gallery, and these hatch in 4 or 5 days. Eggs and young larvae are commonly found in March and adults of this generation appear in late April and May. Eggs and larvae have also been found in late August at 4,000 feet, indicating at least two generations. The winter stage has not been observed. Although this species does kill some small living trees, it is not regarded as a serious pest. An undetermined Hymenopterous parasite has been bred in numbers from its galleries and a Chalcid, *Denotus scolyti*, Ashm., has also been recorded as a parasite of this species. *E. tsugae*, Swaine, attacking *Tsuga mertensiana* and *Pseudotsuga mucronata*, and *E. monticolae*, Swaine, attacking *Pinus monticola* and *Pseudotsuga mucronata*, are both found in British Columbia.

Pseudohylesinus grandis, Swaine, occurring from British Columbia to California and eastward to Idaho and Colorado, apparently attacks only Douglas fir in any stage of growth, being especially bad in saplings and limbs of old trees. Adults appear early in April and construct the primary gallery, in which about 25 eggs are deposited by each female. These hatch in 10 to 15 days; the larval galleries are begun at right angles to the main galleries, but finally turn parallel to it. These pierce both bark and wood, the pupal cell invariably being in the bark. About 6 weeks is required for the life-cycle. In some localities only one generation a year is recorded, but in the Willamette Valley adults emerging in June re-attack the same tree or move to a new host and rear a second generation, which is mature by the middle of September. The adults of this second generation hibernate in the mines. This species principally confines itself to the limbs of large trees in a weakened or dying condition. Large numbers of unidentified parasitic Hymenoptera have been bred from the galleries. Many dead larvae were found infested by bacteria. Experiments will be made to determine whether this disease was the cause of death and whether it is fatal to other members of this family, especially to the genus *Dendroctonus*. *Pseudohylesinus granulatus*, Lec., attacks *Abies grandis* in eastern Oregon and sometimes Douglas fir. The adults excavate short transverse galleries in the cambium of the main trunk or the large limbs of healthy, weakened or recently felled trees, often

killing young trees or seriously injuring older trees. From 18 to 26 eggs are deposited alternately along the main gallery. In 5 or 6 days these hatch and the larvae excavate rather long irregular mines, pupating chiefly in the bark. This pest is not a very serious one, and if the plantation is well cleared in the spring and dying and dead trees burnt, there is little to fear from it. It occurs from British Columbia to California. *P. nebulosus*, Lec., passes the winter as a young adult and occasionally in the pupal stage. Emergence occurs late in March or early in April, and recently felled or injured Douglas fir is immediately attacked. Saplings or limbs of large trees are preferred, thick bark being avoided. The entrance gallery penetrates the bark at a right angle and upon reaching the cambium the insects start a gallery parallel to the grain of the wood, the female working up the trunk and the male in the opposite direction. As the gallery progresses the female makes small niches on each side in which she deposits a single egg, closing up the niche with fine borings. From 15 to 30 eggs are deposited, which hatch in about 5 days, the larval galleries recrossing each other many times. Beetles captured in the wood had evidently passed the winter as young adults; the first eggs were laid in the cages in early April and the life-cycle of these was completed by the end of May. A second generation occurs, the adults of which remain within the bark until spring. The damage done by this species would be very great but for the fact that it prefers hosts that are already dying or injured. It attacks in such numbers and the life-cycle is so short that control is difficult; the tree is in all probability past recovery before any outward signs appear, except the fine dust-like borings that may easily be overlooked. The use of trap trees should be a successful means of control.

Pityokteines (*Dryocoetes*) *minutus*, Swaine, is found in Douglas fir from British Columbia to southern Oregon, in scattered localities. The beetles were found to be mature and ready to leave the tree on 3rd June. They occurred in such vast numbers that in spite of their small size the bark of the trees was honeycombed from top to bottom. For this reason it is impossible to trace the pattern of any individual gallery. This species is not widespread enough to be a serious pest; by felling and burning infested trees in the spring immense numbers of the adults would be destroyed. *Hylurgops rugipennis*, Mann., has been reported as attacking *Pinus*, *Picea*, *Abies* and *Pseudotsuga*, but the author has never found it in Douglas fir, though abundant in *Pinus monticola* and *P. ponderosa*, as well as a few individuals in *Picea engelmanni*. In each case the insects had attacked trees that had been down for years and were abundant in the decayed bark. In the author's opinion it is a pest of secondary importance. *Platypus wilsoni*, Swaine, has been recorded as attacking only sickly trees, but the author has taken it from perfectly healthy examples of *Abies nobilis* and *Pseudotsuga taxifolia* in Oregon. All Pacific coast conifers in a weakly condition are attacked, except the cedar group. The mines extend directly through the bark into the wood. The female deposits some hundred eggs loosely scattered about the gallery in clusters of 10 or 12. The larvae require 5 or 6 weeks for development, and feed on ambrosia fungus. The pupal cells are cut parallel with the grain of the wood and generally occur in groups along the deeper passages. This species is found in southern British Columbia,

Washington and Oregon. Loss from the attacks of this beetle can be avoided by cutting unhealthy timber as soon as noticed and removing all felled timber as rapidly as possible.

There are many undescribed species of the genus *Xyleborus*, several of which are wingless and remain throughout their lives in the galleries where they develop. The only member of this genus attacking Douglas fir is *X. xylographus*, Say (*saxeseni*, Ratz.). The fertilised females pass the winter in the brood chamber, emerging in early spring to attack weak, dying or felled trees. An entrance is made through the bark into the sapwood, which leads to a brood chamber parallel to the grain of the wood; this may be in the sapwood or deep in the heartwood. Attacks are made for preference at the edge of wounds or other insect burrows, or in deep crevices. Several females frequently work at one gallery, one guarding the entrance while the others excavate and expel the borings. Ambrosia fungus is cultivated, and then a few eggs are laid in the gallery, the young larvae feeding upon the fungus. When these have attained a considerable size, more eggs are deposited, and this process continues until there are many larvae present, in all stages of development. These extend the burrows, and during spring and summer, eggs, all stages of larvae, pupae and adults may be found in the galleries. Females may leave the colony from time to time to start new colonies in the same or a different tree, but the original colony will continue to work in the old tree as long as the moisture content of the wood is favourable to the growth of their fungus. The adults apparently live for several years. This species has a wide geographical distribution and a great range of hosts. *Pinus*, *Pseudotsuga*, *Picea*, *Abies*, and *Larix* are among the conifers attacked. It is found from the Atlantic to the Pacific from Canada to Mexico and throughout Europe to Japan. The effect of its attack is to weaken the vitality and hasten the death of the tree. It also ruins lumber and affords entrance to detrimental bacteria and fungi. The beetles *Colydium lineola*, Say, and *Clerus sphegeus*, F., are predaceous on it. Control measures must be chiefly preventive. There is little danger of infestation in trees that are kept in good growing condition, and where dying and dead trees are removed and all broken and dead parts disposed of. For ornamental or shade trees that have been recently attacked an application of coal tar creosote will often destroy the brood and prevent further attack.

Trypodendron lineatus, Ol., penetrates the sapwood and heartwood, the galleries branching considerably and the brood chambers extending above and below the main galleries. Ambrosia fungus furnishes the food of this species and produces the characteristic stain on the wood for some distance from the mines. *Glischrochilus* (*Ips*) *fasciatus*, Ol., is reported as predatory on the beetles. and probably *Thanerocleros sanguineus* is another enemy. This species is a rather serious pest in recently felled timber, particularly of Douglas fir. To prevent loss, felled logs should be removed from the woods as soon as possible or rolled into water. Most of the North American conifers are attacked. *T. ponderosae*, Swaine, has been observed in *Pinus ponderosa* and *Pseudotsuga taxifolia*, doing considerable damage to the sapwood of recently felled Douglas fir. *Gnathotrichus retusus*, Lec., mines the sapwood and heartwood of injured, dying and recently dead trees, logs, stumps and large limbs of Douglas fir. It occasionally attacks

living and healthy trees. The galleries branch considerably, all parts of the same gallery being on the same horizontal plane. There are two generations a year, though these are irregular, larvae, pupae and adults all being present within the galleries at almost any season of the year. Larvae and adults feed on ambrosia fungus and continue to breed and extend their galleries as long as the wood of the host can grow the fungus. Preventive control methods consist of removing immediately all logs cut in the spring and early summer. Since the beetles will not enter logs that are dry or partly seasoned, if these cannot be removed at once they should be placed where the sapwood will season quickly in plenty of air and sunshine. This species is found from British Columbia to Central California and eastward into Arizona and Nevada. *G. sulcatus*, Lec., occurs in the Pacific Coast and Rocky Mountain region from British Columbia into Mexico, in *Pinus*, *Tsuga*, *Pseudotsuga*, *Abies*, *Picea*, *Thuja* and *Sequoia*. The life-history and habits of this species are essentially the same as those of *G. retusus*.

SCHOLL (E. E.). **Division of Entomology. Field Work.**—*Ninth Ann. Rept. Commiss. Agric., Austin, Texas*, 10th September 1916, pp. 11-15. [Received 6th April 1918.]

Cydia (*Carpocapsa*) *pomonella*, L. (codling moth) has done such severe damage as to discourage many apple growers in West Texas, but it has been proved that it can be checked sufficiently to make apple growing profitable. When orchards are well cleared in the autumn, pigs allowed in to dig up insects from the soil, a hot lime-sulphur solution sprayed over the trees in winter, and then, after blooming, three sprayings of 1 lb. lead arsenate to 25 U.S. gals. water given, very little trouble is experienced from this pest. *Aegeria* (*Sanninoidea*) *exitiosa*, Say (peach borer) is best controlled by making mounds round the trees with earth in the summer-time and removing them in January or February so that the larvae are exposed and destroyed by cold ; this has been found more efficacious than worming or applying repellent washes. *Aspidiotus perniciosus* (San José Scale) and *Scolytus rugulosus* (fruit-tree bark-beetle) have done a good deal of damage in north and east Texas. Pruning and spraying demonstrations with commercial lime-sulphur were given and effective work on these lines was done. Small twigs of fruit trees containing sour sap were used as traps for the bark-beetle, and then burned, with great success. *Blissus leucopterus*, Say (chinch bug) was troublesome in April and May, though where crop rotation and clean culture were practised infestation was not heavy. As a result of spraying experiments with several substances it was found that the most successful were a solution of 1 lb. laundry soap to 100 U.S. gals. water with $\frac{1}{2}$ pint nicotine sulphate, and a 10 per cent. kerosene emulsion. *Aphis gossypii*, Glov. (melon aphis) was sprayed with many solutions, the most efficacious being 1 lb. octagon laundry soap to 100 U.S. gals. water with 1 pint Blackleaf 40, the nicotine being added while the soap solution was very hot. This solution did not injure the blossoms. Several thousands of *Hippodamia convergens* were imported, which served materially to hold the pest in check. *Cylas formicarius* (sweet potato borer) has been increasing in the coastal

areas. It was found that dipping or spraying plants in arsenicals had practically no effect on the weevil. Growers are urged to let pigs or sheep clear up potato refuse in the fields after harvest, to plant runners of the vine instead of slips and to destroy the latter, these methods being found the most efficacious in producing good sound tubers in the new crop. Strawberry plants were infested with white grubs (*Lachnosterna*), *Pamera* sp. and red spider. The two last-named were successfully sprayed; white grub control is only just being undertaken. *Murgantia histrionica*, Hahn (harlequin cabbage bug) did considerable damage to cabbage, turnips, etc., in gardens. Early trap-crops of mustard were destroyed when fully infested by the insects by means of pure kerosene oil. A large grove of privet that was being destroyed by these bugs was sprayed with a caustic potash whale-oil soap and red engine-oil emulsion, which acted as a repellent as well as destroying many of the adult insects. Against *Diabrotica vittata* and *D. duodecimpunctata* on cucumbers, cantaloups and watermelons in early spring, a mixture of equal parts of tobacco dust and lime gave some relief, but thorough spraying with Bordeaux mixture (4 : 4 : 40) showed the best results. *Epicauta vittata* (striped blister beetle) was destroyed on lucerne and tomatoes by a bait consisting of 25 lb. wheat bran, 1 lb. arsenic, 1 quart molasses and about 1 U.S. gal. water. The best measure against *Contarinia (Diplosis) sorghicola*, Coq. (sorghum midge) is to plant sorghum early, so that it has time to produce seed before the warm nights when the pest oviposits. Other remedial measures are the burning of Johnson grass, which is the principal host-plant, in the fields, winter destruction of seed heads and fumigation with carbon bisulphide of all seed kept through the winter. The numbers of *Oncideres texana* (twig girdler) on pecans and other trees were greatly reduced by collecting the beetles and cutting off twigs containing eggs. *Lagoa pyxidifera* (flannel moth) and *Automeris io* on hackberry and other shade trees were controlled by spraying with 1 lb. lead arsenate in 25 U.S. gals. water. *Thyridopteryx ephemeraeformis* (bag worm) damaged evergreens and pecans. Removing the winter bags and spraying the spring brood with lead arsenate gave satisfactory results.

Ohlendorf (W.). **Notes on Rhinoceros Beetle (*Oryctes rhinoceros*, L.), injuring Palms in South Texas.**—*Ninth Ann. Rept Commiss. Agric., Austin, Texas*, 10th September 1916, pp. 20–22. [Received 6th April 1918.]

Reports from various districts show that *Oryctes rhinoceros* oviposits in manure heaps, dead palms, or other decaying vegetable matter in moist situations during the summer. The length of the stages in its life-history are unknown, but adults emerge from February to May. The only food-plants known in southern Texas are maguay and palm, of which the former seems to be preferred. Young and tender palms are always preferred to older ones. Various methods of control are suggested, but must be tested before any of them can be recommended as economic methods, such as trapping the beetles with lights or killing them in their burrows by fumigation with carbon bisulphide. The latter method has given varying results; the liquid poured into the burrow is said to kill the tree in many cases, while rags soaked in carbon

bisulphide put in the burrows, which are then closed, do not always destroy all the beetles. The larvae should be destroyed in their natural breeding grounds, or can be trapped by preparing suitable breeding places.

BAGNALL (R. S.). **Brief Descriptions of New Thysanoptera.—IX.**—*Ann. Mag. Nat. Hist., London*, 9th Series, i, no. 3, March 1918, pp. 201–221.

Among the species dealt with are :—*Ceratothripoides brunneus*, sp. n., from the Gold Coast, on kola shoots and flowers ; *Aptinothrips ruficornis* var. *connaticornis*, Uzel, from India, associated in tea flowers with *Physothrips lefroyi*, Bagn., the former being also common in Europe and North America ; *Physothrips peculiaris*, sp. n., from India, on lucerne ; *Haplothrips tenuipennis*, sp. n., from India, on tea-bushes ; *Podothrips propinquus*, sp. n., and *Eurhynchothrips convergens*, sp. n., from the Gold Coast, on kola shoots and buds ; and *Klinothrips femoralis*, sp. n., from the Gold Coast, on foliage of cacao.

DAVEY (H. W.). **Diseases of Fruit Trees and their Treatment.**—*Jl. Dept. Agric. Victoria, Melbourne*, xvi, no. 2, 11th February 1918, pp. 101–107. [Received 23rd April 1918.]

In this paper the author deals with the common insect pests of fruit trees in Victoria, including—codling moth [*Cydia pomonella*], cherry and pear slug [*Eriocampoides limacina*], woolly aphis [*Eriosoma lanigerum*], peach aphis [*Myzus persicae*], mussel scale [*Lepidosaphes ulmi*], San José scale [*Aspidiotus perniciosus*], olive scale [*Saissetia oleae*], Rutherglen bug [*Nysius vinitor*], Pyrrhocorid bugs attacking fruit, red spider [*Tetranychus telarius*] and thrips. The usual insecticides are recommended, and formulae and directions for their preparation are given.

Wheat Storage Problems. Protection from Weevils.—*Jl. Dept. Agric. Victoria, Melbourne*, xvi, no. 2, 11th February 1918, pp. 117–119. [Received 23rd April 1918.]

The special committee appointed by the Commonwealth Advisory Council of Science and Industry, record, in Bull. No. 5 of the Council, the result of their investigations on the protection of stored wheat from weevils, and on the treatment of damaged grain. Only two grain weevils (*Calandra granaria* and *C. oryzae*) are destructive enough to require special measures, those recommended being the careful avoidance of old, weevil-infected bags and buildings, and the dry storage of sun-dried wheat. Experiments have proved that the weevils will not breed in sun-dried wheat which contains only 4·7 of moisture, nor in threshed wheat containing 6.7 per cent. With 8 per cent. of moisture they died in six weeks without breeding, with 9 per cent. they remained dormant, but with anything above this amount, provided they had free air, they became active and increased. Therefore, in a fairly dry climate it should be possible to store wheat for an indefinite period without any damage from weevils, provided that it is completely protected from the weather.

In the treatment of damaged grain, tests were carried out on the effects of quicklime on (1) good, (2) weevily, (3) tainted, (4) damp and damaged, (5) mouse-tainted wheat. In each case the wheat was first passed through a small wheat cleaning machine, then mixed with 1 per cent. of its weight of quick-lime and stored for 14 days. It was found that the addition of quick-lime to sound grain is in no way harmful, and may even effect some slight improvement. In the case of weevily wheat it caused the removal of the adult weevils and the infested grain upon screening, but the weevils were not killed, this being effected only by adding lime at a high temperature. The tainted wheat lost nearly 20 per cent. and the musty and mousey odours were much reduced, though their complete removal would require contact for several months with lime applied fresh and hot. Damp wheat proved to be incapable of conversion into a wholesome article, though the odour and bacteria present were materially reduced by the lime. The treatment of mouse-tainted wheat gave very satisfactory results, which showed, however, that the lime, to be effective, must be applied hot.

SCHENK (P. J.). **De Erwtenkever.** [The Pea Weevil.]—*Tijdschr. Plantenziekten, Wageningen,* xxiv, no. 1, 15th February 1918, pp. 15–24, 1 fig.

The information given in this article on *Bruchus pisorum* has been taken from existing literature, and the remedial measures advised are the usual ones, consisting of exposure to a temperature of 122° F., fumigation with carbon bisulphide or hydrocyanic acid gas, and the warming of the peas during the month of February, thus inducing the beetles to emerge.

SCHOEVERS (T. A. C.). **De Bloedluis** (*Schizoneura lanigera,* **Hausmann**). [The Woolly Aphis, *Eriosoma lanigerum.*]—*Tijdschr. Plantenziekten, Wageningen,* xxiv, no. 1, 15th February 1918; Bijblad, pp. 7–16, 2 figs.

This article deals with *Eriosoma lanigerum* and its control from a popular and practical point of view and contains no new information.

DEN DOOP (J. E. A.). **De Verspreiding van *Trichogramma,* den Eiparasiet van *Heliothis obsoleta,* Fabricius, ter Oostkust van Sumatra.** [The Spread of *Trichogramma,* the Egg-Parasite of *H. obsoleta,* on the East Coast of Sumatra.]—*Meded. Deli Proefstation, Medan,* x, no. 9, February 1918, pp. 213–220, 1 map.

From 1908 to 1910 attempts to find egg-parasites of *Heliothis obsoleta,* F., in Java and Sumatra were unsuccessfully made by Dr. L. P. de Bussy, who consequently introduced in 1911 *Trichogramma minutum* (*pretiosum*) from North America into Sumatra, where it has now established itself [see this *Review* Ser. A, i, p. 13].

Since 1916 the author has investigated the hosts of this parasite and its spread under field-conditions. Insects parasitised in the laboratory are not necessarily attacked in the field and *vice versa.* In the field most of the parasites are small and with weak ovipositors, so that

they are unable to penetrate the hairs covering the unattached end of the egg of *Ergolis ariadne*, L., or pierce eggs in small heaps covered with hairs, as in the case of *Hypsa alciphron*, Cram., and *Prodenia litura*, F. (*littoralis*, Boisd.). If the host-eggs are laid on leaves with a sticky surface, as in the case of those of *H. obsoleta* on young tobacco, the parasites are unable to reach them. On the other hand, the Lycaenid, *Lampides* (*Polyommatus*) *baetica*, L., was not parasitised in the laboratory, but wherever its eggs occur on *Crotalaria striata* on the East Coast of Sumatra, *T. minutum* is abundant.

The following is a list of the principal hosts of *Trichogramma* in the field: *Heliothis obsoleta*, F., from *Physalis angulata*, *Zea mays*, *Macaranga* sp., *Passiflora foetida*, *Crotalaria striata*, and *Momordica charantia*; *Lampides baetica*, L., from *Crotalaria striata*, *C. incana*, *C. usaramoensis*, *Vigna catjang*, and *P. foetida*; *Hippotion celerio*, L., from *Colocasia antiquorum* and *C. indica*; *Achaea janata*, L. (*Ophiusa melicerta*, Drury), from *Ricinus communis*.

Physalis angulata, *Zea mays* (maize) and *Passiflora foetida* favour the development of *H. obsoleta*. *P. foetida* is of such little importance, however, that no measures need be taken against it, while maize is cultivated only to a limited extent by the natives. The *Physalis* is decidedly harmful, as the young caterpillars bore into the fruit-buds and are there sheltered until they migrate in order to pupate underground, whence the adults emerge at the time that tobacco is planted out in the field. Plants useful against *H. obsoleta* are *Crotalaria striata*, *C. incana*, *C. usaramoensis*, *Amorphophallus* sp., *Ricinus communis*, and *Urena tomentosum*, though *C. striata* is the only one of practical value. It must be remembered that *Trichogramma* does not develop in large numbers on its host living on this plant until it bears fruit, so that planting must be effected sufficiently early. The spread of the parasite is most probably due to the mid-day winds, so that *C. striata* should be planted in a position which at mid-day will be to windward of the plantation requiring protection.

When investigating the distribution of *T. minutum* in Sumatra the discovery of the Lycaenid host, *Lampides baetica*, L., on *Crotalaria* proved to be of the greatest importance, because this plant is almost always found in tobacco plantations, where its use as a green manure is constantly increasing and the eggs of *L. baetica* abound on it. Most of these eggs are parasitised by *T. minutum*.

The conclusions reached are that *T. minutum* can be used against *H. obsoleta* and perhaps also *Phytometra* (*Plusia*), but not against *Prodenia*, *Phthorimaea* (*Lita*) and *Botys*. The eggs of *H. obsoleta* are rarely attacked on tobacco because of the stickiness of the young tobacco leaves. The percentage of parasitism of the eggs of this moth on *Physalis angulata*, L., must be increased, while this plant must be kept down as much as possible. The former may be brought about by increasing the parasitism of other eggs, those of *L. baetica* on *Crotalaria striata* being the most suitable. The *Crotalaria* should be planted round the tobacco field before the tobacco is planted out, in order that the moths may lay their eggs on it instead of on the tobacco. The collection of the caterpillars and spraying with Paris green and lead arsenate are the best remedies in cases of infestation of tobacco.

VAN DER GOOT (P.) & ROEPKE (W.). **Beknopt Verslag der *Helopeltis*-bijeenkomst (28 Juli 1916).** [A brief Report of the *Helopeltis*-Conference of 28th July 1916.]—*Meded. Proefstation Midden-Java, Salatiga*, no. 29, n. d., 22 pp.

The ground covered by the discussions at this meeting has already been dealt with in several papers on *Helopeltis* [see this *Review*, Ser. A, iv, p. 442; v, 413, 570].

CARBALLO (E.). **Informe acerca de las Causas de la Infertilidad de los Olivares del Ternimo de Jerez y del Lindante de Arcos de la Frontera.** [Report on the Causes of Infertility of Olive Trees in the Districts of Jerez and Arcos de la Frontera.]—*Bol. Agric. Técnica y Económica, Madrid*, x, no. 111, March 1918, pp. 217–230.

The chief disease of olive trees is caused by a fungus that follows upon the attacks of *Saissetia* (*Lecanium*) *oleae*, which clusters under the leaves and on the branches of the trees. For the district under discussion the only control that has been found effective is Bordeaux mixture and turpentine. It is considered of the utmost importance to cultivate the trees and plant them in suitable positions only, so that the chief causes of disease, namely, excessive moisture and lack of ventilation, air and light, may be eliminated.

Dacus oleae (olive fly) is the cause of very great loss to olive-growers, severe infestations occurring periodically from unknown causes. A short account of the life-history is given. There is no known method of controlling this fly that is cheap and efficacious. It has been suggested that the olives should be gathered early, before the larvae of the last generation have left the fruit, and that if all are not killed by this means in one year it should again be practised in the following year. After early gathering of the fruit it should be crushed immediately and the refuse left at the oil-mills should at once be burnt. It is essential, for this measure to be successful, that all olive-growers in a given region should make this early harvest, otherwise the operation would be absolutely useless. The only other possibility of exterminating this pest is to wait until it is destroyed by climatic conditions, as in the year 1897, when unusually warm weather in February and March caused a rapid development of *D. oleae*, which arrived at maturity, but could find no olives on which to oviposit as these had not yet appeared. In combating these insect pests, insectivorous birds should be carefully protected.

LEGISLATION.

Amendment no. 1 to Quarantine Order no. 29, Alfalfa Weevil.—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, vii, no. 3, March 1918, p. 170.

As *Hypera variabilis* (*Phytonomus posticus*) (alfalfa weevil) has now invaded Delta County, Colorado, this amendment dated 31st January 1918 has been issued in California to include this County in the list of quarantined areas.

Reports on the State of the Crops in each Province of Spain.—*Bol. Agric. Técnica y Económica, Madrid*, x, no. 111, March 1918, pp. 247–265.

In the Province of Badajoz a spring campaign is being organised against locusts, and, as large areas remained untreated in the winter, it is considered that the measures ordered by the local councils are insufficient and additional help has been sought from the State in order to avoid unnecessary losses to crops. The same conditions prevail in Cáceres, while a great abundance of locust eggs, some of which are already hatching, is reported from Córdoba.

MAZIÈRES (A. de). **Enquête sur L'Eudémis.** [Investigation regarding *Polychrosis botrana*.]—*Rev. Hortic. de l'Algérie, Algiers*, xxii, no. 3, March 1918, pp. 35–39.

The history is given of the infestations of *Polychrosis botrana* that have occurred in Algeria since 1904, when the pest was introduced. The various methods of control that have been tried for this vine-moth and for *Clysia ambiguella* are reviewed. The results have shown that, as soon as the presence of the moths or of young larvae is observed, the most efficacious way of protecting the vine is by spraying the fruit with some substance that will repel oviposition and poison the larvae. This includes two treatments, namely, two sprayings in spring with arsenicals and a summer treatment with nicotine. Lead arsenate mixed with Bordeaux solution is given in two applications at 8 to 15 days' interval; summer treatment begins as soon as the grapes begin to develop; for this, nicotine should be mixed with a copper solution. For the last few years the majority of vine-growers have gathered infested grapes before maturity in order to destroy the larvae embedded in the pulp; this naturally reduces the quantity of the crop. It has been noticed that the flights of moths are always more abundant around farm buildings, where they seem to be attracted either by the shelter afforded from strong winds or by lights. For this reason light and bait traps placed in the vicinity of such buildings collect more individuals than those placed elsewhere.

Several causes are suggested for the lack of success in spraying recorded by vine-growers. These include faulty preparation of the spraying mixtures, economy in the use of sprays, and their bad distribution. Those who are in the habit of treating vines for mildew tend to spray the young leaves only and forget to sprinkle the future grapes. Applications against the first generation are often left too late, thus allowing future generations to occur. Acetates are mixed with copper solutions of varying powers of spreading. Preliminary defoliation, which allows the operator to reach the fruit more easily, is frequently omitted. The insecticides are sometimes washed away by rain just as the larvae are hatching.

DICKERSON (E. L.) & WEISS (H. B.). *Corythucha spinulosa*, **Gibson, a New Lace-bug on Wild Cherry (Hem. Hom.).**—*Entom. News, Philadelphia, Pa.*, xxix, no. 4, April 1918, pp. 121–125, 1 plate.

Up to the present *Corythuca spinulosa*, the food-plant of which is wild cherry (*Prunus serotina*), has been found only at one place in

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New Jersey, where it appears to be rather well distributed over a small wooded section. The over-wintering adults appear early in June, oviposition occurring till about June 20. The eggs are deposited in the midrib of the leaf on the under-surface, from 4 to 35 being present on one leaf. The egg-stage requires from 2 to 3 weeks and the nymphs on hatching feed in colonies on the under-surface of the leaf along the midrib, disfiguring it by varnish-like spots, and causing a whitish discoloration of the upper surface. Adults of the first brood are present by the end of July, and those of the second brood by the latter part of August.

GIRAULT (A. A.). **New and old West Indian and North American Chalcid-flies (Hym.).**—*Entom. News, Philadelphia, Pa.*, xxix, no. 4, April 1918, pp. 125–131.

The species dealt with in this paper include *Grotiusomyia nigricans*, How., reared from the larva of *Eudamus proteus* in St. Vincent; *G. flavicornis*, Gir., reared from a Pyralid leaf-miner on oak at Washington; *Polycystus clypeatus*, sp. n., reared from a leaf-miner on maize in St. Vincent; *Sycophila incerta*, Ashm., and *Idarnes carme*, Walk., reared from *Ficus laurina* in Barbados; *Bruchobius laticeps*, Crawf., associated with cowpea weevils in Texas; *Pseudomphale eudami*, sp. n., reared from the larva of *Eudamus proteus* in St.Vincent; *Omphalchrysocharis petiolatus*, sp. n., reared from an Oscinid on daisy at Washington; and *Arthrolytus aeneoviridis*, Gir., from *Bucculatrix thurberiella*, on cotton in Arizona.

BARSS (H. P.) & LOVETT (A. L.). **Spraying Stone Fruits.**—*Oregon Agric. Coll., Corvallis*, Extension Service Bull. no. 291, March 1918, 8 pp.

This bulletin gives in a condensed form information as to the best means of combating the common insect and fungus orchard pests. Spray calendars are given for the treatment of prunes and plums, peaches, and cherries respectively.

ALLEN (W. J.). **The Peach Tip Moth.**—*Agric. Gaz. N.S.W., Sydney*, xxxix, no. 2, February 1918, p. 132. [Received 29th April 1918.]

The dying of the tips of the young shoots of peach trees is caused by the newly-hatched larvae of this Tortricid moth eating their way down through the centre of the shoot. Attempts to control the pest with lead arsenate sprays have not given satisfactory results, since they afford protection for a very limited time owing to the rate of growth of the tip. The best method of control is the removal and burning of the tips while still containing the larvae, and the destruction by burning or boiling of the fruits infested by the later broods of the moth.

FULLAWAY (D. T.). **Division of Entomology.**—*Hawaiian Forester & Agriculturist, Honolulu*, xv, no. 2, February 1918, p. 36. [Received 25th April 1918.]

During the month of January the insectary handled 33,100 pupae

of the melon fly [*Dacus cucurbitae*] from which were bred 1,609 individuals of *Opius fletcheri*. The parasites distributed included:—*Opius fletcheri*, 1,391; *Diachasma tryoni*, 58; *D. fullawayi*, 45; and *Paranagrus* (corn leaf-hopper parasite), 34,500.

AGEE (H. P.). **Director's Report.**—*Rept. Expt. Sta. Committee, Hawaiian Sugar Planters' Assoc. for Year ending September 30, 1917, Honolulu*, 12th October 1917, pp. 6–25. [Received 30th April 1918.]

The beetle, *Anomala* [*orientalis*] has been gradually spreading in sugar-cane fields in Hawaii; although some fields formerly attacked, are now free from it, the badly infested area is a little larger than last year. The spread of this pest has recently been chiefly in the direction of irrigation ditches and along railways and other lines of communication from infested fields. But for the fact that oviposition has usually occurred prior to flight, the damage done by this beetle would be much more severe than it is. During 1916 a great deal of work was done in connection with the introduction of parasites [see this *Review*, Ser. A, v, p. 426]. By the end of the year one wasp, *Scolia manilae*, had become so well established that introduction was discontinued. Other parasites imported include *Tiphia ashmeadi*, about 600 cocoons of which were received from the Philippines. The host of this parasite is a different beetle, but it breeds on *Anomala* spp. to some extent. *T. segregata* breeds upon grubs of *Anomala*, but the emergence of this species is slow and irregular. A few however were liberated. Another species of *Tiphia* from Japan was liberated in a field infested with grubs of *Anomala* sp., as there was no evidence of this species having become established from previous importations. A species of *Prosena* from the Philippines was liberated in sufficient numbers to become establisbed. *Dexia* sp. was liberated in small numbers, but its chance of becoming established is considered small. An attempt has been made to establish a Japanese Carabid, *Craspedonotus* sp., with what result is not yet known.

Outbreaks of the leaf-hopper [*Perkinsiella saccharicida*] have been severe in a number of plantations. It is considered probable that this species is able to multiply rapidly only under abnormal conditions and then only until the parasites regain control. Heavy rainstorms, particularly if accompanied by high winds, the harvesting of large areas and migration of the leaf-hoppers to areas that have been free from them and hence clear of parasites, are among the disturbing factors. It is suggested that the parasites should be distributed artificially in large numbers in order to re-establish control of the pest. Thirty colonies of *Ootetrastichus* sp. (Formosan leaf-hopper egg-parasite) have been distributed and have been found to be established on two plantations, but on the whole results with this parasite are considered disappointing. The Chinese Dryinid is reported to be now established in most plantations infested with the cane leaf-hopper. The cane borer [*Rhabdocnemis obscurus*] is fairly held in check by its Tachinid parasite [*Ceromasia sphenophori*], except where rats facilitate the work of the borer. Fresh colonies of the parasite continue to be distributed.

ADERS (W. M.). **Entomology in Relation to Agriculture.**—*Zanzibar Protectorate Ann. Rept. Pub. Health Dept. for 1916, Zanzibar,* 1917, p. 36.

No serious outbreak of insect pests has occurred during the year. *Ceratitis capitata* (Mediterranean fruit-fly) has been found infesting imported oranges and mandarins, but the distribution is not widespread and apparently native-grown trees are far less susceptible. This fly may become a menace to the citrus industry, and its control is a serious problem.

Oryctes monoceros and *O. boas* are prevalent and injurious to coconuts in Pemba.

ROBERTS (A. W. R.). **Report on Aphidae for 1916.**—*Lancashire & Cheshire Naturalist, Darwen,* x, no. iii, June 1917, pp. 78–79.

The Aphids recorded include:—*Pemphigus bursarius,* L., and *P. filaginis,* Boy., on poplar; *Lachniella nigrotuberculata,* Del G., on *Larix leptolepis*; and *Aphis sambuci,* L., on elder.

The following Hymenopterous parasites and hyper-parasites of Aphids were taken:—*Aphidius ribis,* Hal., from *Myzus ribis*; *Aphidius* sp., from *Aphis ?holci.* Ferr.; a species of *Praon,* either *P. flavinode* or *P. volucre,* Hal., from *A. abietina,* Wlk.; *Allotria* sp. from *A. brassicae*; *Lygocerus* sp. from *A. avenae*; *Lygocerus* sp., from *Amphorophora ampullata,* Buckt.; *Asaphes vulgaris,* Wlk., from *Aphis ?holci, Myzus ribis,* and *Amphorophora ampullata.*

COGAN (E. S.). **Some Phases of Applied Entomology in South Africa.**—*S. African Jl. Science, Capetown,* xiv, no. 6, January 1918, pp. 260–262. [Received 1st May 1918.]

The author points out that while South Africa is economically a young country, it is progressing so rapidly that it is taking a foremost place in respect of fruit culture and the production of grain and other crops. Entomological problems are diverse and numerous and require attention from various aspects, as well as initiative, adaptability and perseverance on the part of the entomologists dealing with them. Attention is drawn to what the author considers the important factors in this work. As the field is large, covering a great stretch of country with varying geographical conditions, the training of the entomologist should be on broad and fundamental lines, and should include some study of the closely related sciences of botany and bacteriology. The opportunities for developing specialised branches of entomology are boundless. The discovery of new, cheap, and if possible more efficient chemical compounds for use in insect control work is an immediate necessity. Many other lines of research are suggested; the reactions of plants to various stimuli, choice of resistant varieties, control of insects by natural parasites, and ecology or the inter-relationship of animals and plants, are among the subjects that offer great possibilities to the investigator.

SHARPLES (A.). *Ustulina zonata* (Lev.) Sacc. on *Hevea brasiliensis.*—*Ann. App. Biol., Cambridge Univ. Press,* iv, no. 4, March 1918, pp. 153–178, 6 plates, 1 text-fig. [Received 3rd May 1918.]

Rubber trees on Malayan plantations have hitherto been remarkably free from insect and fungus troubles, and in consequence no great attention has been paid to combating them. The Scolytid beetle, *Xyleborus parvulus,* was first observed attacking rubber in Malay in 1909, in one district only where many trees had been pollarded. The method of planting rubber trees necessitates the cutting out of large numbers when they reach the age of 6 or 7 years and during the thinning, attacks by boring beetles on the permanent trees become prevalent, and it was found that fructifications of the fungus occurred on the surface of the attacked parts. Evidence indicates that there is a close connection between attacks by boring beetles and *Ustulina zonata.* After fires on several estates boring beetles quickly entered the bark of damaged trees, and while these attacks were quickly followed by fungus disease, in no case was the fungus found in trees where the borers were entirely absent. As an experiment, the bark of 24 rubber trees was scraped and five of these were quickly attacked, three by borers. Two of these showed traces of *Ustulina zonata* in the bark five weeks after the insects had entered. It was observed that the borers disappeared after the first fortnight. This experiment showed that the important protective layer in rubber trees is the outer layer of corky cells and, if this layer is injured, attacks by boring beetles quickly follow. The first borers attempting an entrance were trapped in the streaming latex, but later arrivals succeeded in entering through places prepared by their predecessors. During the process of thinning out, falling trees come in contact with and bruise the branches and trunks of neighbouring ones, wounding the outer corky layers, and through these wounds the borers enter, being quickly followed by the fungus. It is possible that borers may directly transfer fungus spores to the trees they enter. Such insects as termites, ants, etc. walking over spore-producing fungi would carry away numerous conidia or ascopores attached to their appendages, and fructifications in the conidial stage have been found showing traces of insect markings on the surface. The function of termites in this connection appears to be of minor importance, as the number of trees attacked by them and by *U. zonata* is small compared with those attacked by borers and the fungus or the number of old trees suffering from fungus attack only.

U. zonata is largely responsible for the death of trees attacked by the borers, which would not in themselves be a serious trouble. It is therefore obvious that strict attention must be given to all trees, stumps or logs in which borers are working. These should be immediately cut out and destroyed, as they represent one of the worst sources of infection. All trees scorched by fire should be carefully watched, and, if borers attempt to enter, a coating of tar (80 per cent.) and crude oil (20 per cent.) should be applied to the scorched surfaces, a second coating being given if possible. Scorching of the high branches is less easily dealt with, but these are not apparently much attacked by insects, and in any case they can be readily cut away from the main stem. Clearing the ground of rotting timber and the treatment of jungle stumps will largely prevent trouble from termites.

EFFLATOUN (H. C.). **Notes on the Strawberry Leaf Beetle** (*Galerucella tenella*, **Linn.**).—*Ann. App. Biol., Cambridge Univ. Press*, iv, no. 4, March 1918, pp. 206–210, 3 figs.

Larvae of *Galerucella tenella* (strawberry-leaf beetle) have lately been doing considerable damage to strawberry plants in County Monaghan, Ireland. This paper gives some notes on the life-history, but it is hoped that fuller details of the bionomics will be published later. The stages of the insect from larva to adult are described. Both larvae and adults eat the upper and lower epidermis and the soft underlying tissue, leaving the opposite layer of epidermis intact. If these injured leaves are left exposed to weather conditions, the wounds develop into holes through the leaf and are misleading in identifying the insect causing the damage. The larvae were mature when received, so that nothing is known of their earlier history; pupation occurred on 21st to 24th June, the adult beetles appearing on the 22nd to 26th July. At the least sound the beetles feign death and drop to the ground, where they burrow out of sight. They feed chiefly during the night or early morning.

PETHERBRIDGE (F. R.) & HUSAIN (M. A.). **A Study of the Capsid Bugs found on Apple Trees.**—*Ann. App. Biol., Cambridge Univ. Press*, iv, no. 4, March 1918, pp. 179–205, 3 plates.

This paper gives an account of investigations undertaken to determine the exact damage to apples done by Capsids which have been the subject of earlier studies [see this *Review*, Ser. A, v, p. 290], and records fuller details of their life-histories. The information collected is however only the result of preliminary study and further work in this direction is being carried on. The species of Capsids damaging apple trees in England are *Plesiocoris rugicollis, Orthotylus marginalis, Psallus ambiguus, Atractotomus mali* and *Lygus pratensis*.

Plesiocoris rugicollis was found to be the only Capsid that caused marking of the leaves, fruit or shoots, the damage done by the other species being unimportant. The eggs of this species are laid in June and July in the soft stem of the current year, in many cases very near the apex and in some cases at the thickened bases of the twigs. They are apparently deposited indiscriminately in lenticels or in slits made for the purpose in other parts of the stem. The eggs remain in the shoots throughout the winter, and after a few months it is impossible to detect their presence in the shoot by external examination. If the bark is peeled off, the eggs are generally found adhering to the inner side of it. The larvae hatch during April and at once begin to feed on the tender or half-opened leaves, usually on the upper surface. It is difficult to shake them from the trees at this stage, as they usually obtain a hold on some lower portion of the tree. The five instars of the immature insects are described. Several stages may be present at the same time on the trees. When the fruit sets, the bugs are in the 3rd, 4th and 5th stages, and shortly after this they begin to injure the fruit and continue to do so until the apples are about an inch in diameter. Adults feed chiefly on the leaves and shoots and do very little damage to the fruit. When the young stem is punctured a brown fluid oozes out and the stem frequently cracks and may be

killed. The slow-growing varieties of apples suffer particularly from Capsids; badly marked apples only grow to about one-fourth of their normal size and often fall off.

The stylets of all the species of Capsids dealt with are very similar, and the cause of the damage would seem to be chemical rather than mechanical, the salivary injection from *P. rugicollis* being injurious to the tissue of apple trees, whilst that of the other species is not. This supposition is borne out by the fact that it is the mesophyll and not the epidermis that shows the first sign of injury, and dead mesophyll may be present under a healthy epidermis and the damaged area may spread for some time after laceration has taken place. In the case of *P. rugicollis* the mechanical injury is probably of little consequence. *Psallus ambiguus* and *Orthotylus marginalis* are sometimes as numerous as that species, and yet the injury caused by their sucking the juices is of no importance. An insect that causes mechanical injury would probably do so to all plants that it feeds on, but the injection of an insect that causes physiological injury might affect different plants in different ways, and even be harmless to some plants as well as much less harmful to some varieties of plants of the same species than others.

While certain pests are specific in their attacks, others infest a large number of plants. *Lygus pratensis* is known to attack fifty different species of plants. *Plesiocoris rugicollis* was formerly known to attack *Salix* and *Alnus*, but it now attacks apple, black and red currants, and under experimental conditions has been made to attack plums. This change of diet may be comparable with mutations in the morphological characters and is perhaps due to some physiological change in the organism. *P. rugicollis* may in the future become a more serious pest by extending its host-plants. The change of diet of this species may simply be due to a fertilised female being blown on to a new host, and being unable to reach the original one, the insect may feed upon and oviposit on the new plant. The larvae that hatch from these eggs will probably be able to live on the tissues of the host on which the mother lived and are in any case incapable of reaching the original host. Further experiments in this direction are required, but it is known that nymphs can be made to change their hosts, for example from apple to plum and black currant to apple, and it would be of interest to know whether *P. rugicollis* would oviposit on a species distinct from that on which it was reared. It is evident that *P. rugicollis* normally lays its eggs on the host on which it has fed, and does not readily change any host on which it can live, for apples and willows are found interlacing and only the willows attacked, or apples and black currants with only the latter attacked. In Cambridge, where apples are not attacked, but only willows and black or red currants, larvae were transferred from black currants to apple trees and, although they did not at once feed, they became accustomed to their new host and completed their development.

Experiments have shown that *P. rugicollis* can be kept in check by spraying with soft soap and nicotine. About 1 per cent. of soft soap is sufficient with soft water, or more with hard water, and 0·05 per cent. of nicotine (98–99 per cent.). This rapidly kills all stages of the insect except the eggs. The wash should be applied just after

all the bugs have hatched and spraying may continue for some time after the fruit has become marked. A high pressure pump and a fairly coarse nozzle should be used. The trees should be thoroughly drenched in a downward direction. As eggs are laid in the young shoots, trees from an infested nursery should not be planted in non-infested areas.

Orthotylus marginalis, Reut. (*nassatus*, Fall.) hatches about a fortnight later than *P. rugicollis*; this species is not of any importance as a pest. *Psallus ambiguus*, Fall. (*obscurus*, D. & S.) hatches about the same time as *P. rugicollis*, and apparently does no damage. It was observed that the larvae of this species lived and developed for weeks on dried shoots without any leaves, indicating some other source of food than plant juices. On these twigs were eggs and nymphs of the apple-sucker (*Psylla mali*) and eggs and young of red spider (*Tetranychus* sp.), and it seems likely that besides sucking plant juices to a certain extent *Psallus ambiguus* may be carnivorous and therefore beneficial. *Atractotomus mali*, Mey., has not been observed to do any damage to apples.

No insect enemies of Capsids have been observed. *Anthocoris sylvestris* was found sucking the dead bodies of Capsids at various stages, and it is possible that this bug as well as some species of Capsids are capable of killing living Capsids, though they have never been observed to do so.

IMMS (A. D.). **Observations on *Pimpla pomorum*, Ratz., a Parasite of the Apple Blossom Weevil.**—*Ann. App. Biol., Cambridge Univ. Press*, iv, no. 4, March 1918, pp. 211–227, 1 plate, 1 fig.

Anthonomus pomorum (apple blossom weevil) is a very difficult pest to control owing to its being concealed within the unopened blossom buds of the apple during the early stages. The larvae are frequently found in one of the deformed buds, accompanied by the smaller larva of *Pimpla pomorum*, Ratz., which is an ecto-parasite of both larvae and pupae of the weevil. When the larva of *P. pomorum* is fully fed, it spins a slight silken cocoon within the bud-cavity, the adults beginning to emerge about the 17th June or some 23 days after pupation began. The male parasite was found in considerable numbers for the first time and was identified. After emergence in June the life-history of *P. pomorum* during the rest of the year is unknown. Most probably it passes through a second generation and utilises certain species of Lepidoptera as hosts. In localities where *A. pomorum* does not occur both generations probably parasitise Lepidoptera. Among 1,270 apple buds from Cambridgeshire infested with *A. pomorum* 27 per cent. were found to be effectively parasitised by *P. pomorum*.

An account is given of Decaux's method of preserving Braconid parasites of *A. pomorum* in France in 1880. About 13½ bushels of infested buds were collected from 800 apple trees; these were preserved in boxes covered with gauze, which was raised from time to time to allow of the escape of the parasites. By this means some 250,000 parasites were liberated, and repetition of the operation in the following year was sufficient to prevent serious damage from the weevil during the succeeding ten years. It is suggested that

methods on these lines should be given an adequate trial in the case of *P. pomorum*.

A description of the male of *Pimpla pomorum* by Mr. Morley is appended.

GREEN (E. E.). **A List of Coccidae affecting various Genera of Plants.**—*Ann. App. Biol., Cambridge Univ. Press,* iv, no. 4, March 1918, pp. 228-239.

This paper forms the second part of the author's valuable list of Coccids and their food-plants [see this *Review*, Ser. A, v, p. 519].

The Control of Pests of Fruit Trees in Gardens and Small Orchards.—*Jl. Bd. Agric., London,* xxv, no. 1, April 1918, pp. 41–53, 3 figs.

This paper, which has also appeared in the form of Food Production Leaflet, No. 39, gives general recommendations for the control of insect pests of fruit crops. A calendar of the necessary routine work is included. A list shows the crops and pests dealt with, references being given to the various leaflets that have been issued on these subjects. Formulae for insecticides are discussed and instructions are given for spraying, with recommendations for suitable spraying machines.

PETHERBRIDGE (F. R.) & HUSAIN (M. A.). **Further Observations on the Capsids which attack Apples.**—*Jl. Bd. Agric., London,* xxv, no. 1, April 1918, pp. 54–58, 6 figs.

The subject matter of this paper has been more fully dealt with elsewhere [see above, p. 278].

IMMS (A. D.). **Tarred Felt Discs for Protecting Cabbages from the Cabbage-root Fly.**—*Jl. Bd. Agric., London,* xxv, no. 1, April 1918, pp. 59–60.

This paper records the successful use of tarred felt discs against *Phorbia* (*Chortophila*) *brassicae* (cabbage-root fly). These have been described previously [see this Review, Ser. A, v, p. 171]. It is suggested that, in the few cases where successful results were not obtained, the following points should be observed. The soil at the time of planting should be in a fine, friable condition: the earth should be worked up slightly round the plants so as to form a flattened ridge; the discs should be applied, if possible, on the same day that the planting out is done.

Kuwa Hamadarabai Chosa. [Researches on the Banded Mulberry Midge.]—*Kangyo Mohanjo Kenkyu Hokoku* [*Bulletin of Industry, Model Sericultural Station*], *Korea*, 15th October 1917, 15 pp., 14 figs.

The very injurious banded mulberry midge (*Diplosis quadrifasciata*, Niwa), previously only known to occur in the vicinity of Tokyo, first appeared in 1915 in a mulberry field at Suigen in Korea. Since then the damage done by it has become more and more serious and widely

spread. Whether it had been imported from Japan or is an endemic species in Korea has not yet been determined. It has two broods in a year, the adult of the first brood appears in May and that of the second in the middle of July. It passes the winter as a larva and pupates in May of the next year. The eggs are laid on the epidermis of new and soft shoots that are in contact with the ground, the newly hatched maggots showing a marked preference for damp spots. If the tree has split bark, the fly lays eggs in it, even if the fissure is some distance from the ground. Larvae that appear on the epidermis bore under the bark and eventually into the cambium. The bark often splits as a result of infestation, so that the flies of the second brood usually oviposit in the cracks produced, which thus often contain larvae in two different stages. Infestation by the maggot causes the shoots or branches to decay, so that they sooner or later die or break off.

As the midge mainly infests the young shoots that are in contact with the ground, the best remedial measure is a system of pruning that leaves only those shoots that are at least five inches above the surface. An excessive amount of moisture in mulberry plantations must also be avoided.

Vedalia **Tento-mushi oyobi** *Icerya* **Kaigaramushi ni Kansuru Kenkyu.** [Researches on the Coccinellid *Vedalia* and the Scale-insect *Icerya.*] *Byokin-gaichu Iho* [*Bulletin of Plant Pathology and Injurious Insects*], *Dept. of Agric. and Commerce, Tokyo,* no. 3, 25th November 1917, pp. 107, 11 plates, 3 maps.

Icerya purchasi, Mask., having been imported into the Prefecture of Shizuoka the principal orange-growing district in 1911, and serious damage having been caused by it, the Imperial Department of Agriculture and Commerce entrusted the study of this pest, as well as of its natural enemies, especially *Novius cardinalis,* Muls., to the Prefectural Agricultural Experiment Station, and gave financial assistance for the purpose. This report is the result of the investigations. *Novius cardinalis,* when reared in breeding cages, appears to have eight generations a year and winters in the larval stage. Out of doors the life-cycle seems irregular, and eggs, larvae, pupae and adults are seen at every season. It usually lays from one to three eggs on the ovisac, or within the body of *Icerya purchasi,* but occasionally also oviposits under the cast skin of the host or on the leaves or branches near by. The female oviposits over a period varying from six to forty-four days according to the season, laying as many as 54 eggs in a day in the summer; in the spring and autumn sometimes only a single egg is laid per diem. The number of eggs laid by a single female varied from 54 to 816. Oviposition takes place to a greater extent by day than by night. The first stage of the Coccinellid larva devours only one or two larvae of *I. purchasi* in a day, while the last may destroy as many as 46. In one case a *Novius* larva consumed 126 young larvae of *Icerya.* The voracity of the adult differs in the sexes; the average consumption of the female was 213 scales of various stages during 15 days, while the male destroyed 136 in 16 days. In the spring the life of the female is 40 days and that of the male 22 days on an average; in the summer the female lives 23 days and the male 13 days. These Coccinellids prey on one another when food becomes

scarce, and besides *Icerya purchasi* they attack *Icerya seychellarum*, Mask., and *Drosicha* (*Monophlebus*) *corpulenta*, Kuw. Though the Coccinellid is rather active during the winter, in the field from 14 per cent. to 22 per cent. of the larvae and from 33 per cent. to 67 per cent. of the pupae, and in the breeding cages from 24 per cent. to 27 per cent. larvae and 47 per cent. pupae, may die off. There are two fungi that infest the larvae and kill them.

In one area of 245 acres of infested orchard 670 Coccinellid larvae were liberated, and after two months the pest was nearly controlled. As this Coccinellid is active from April to August, its introduction to combat *Icerya* should be accomplished at this season. As it is inactive in the winter, no effective result can then be expected from it. It must also be remembered that the liberation of *Novius cardinalis* even in large numbers cannot seriously check injury by *Icerya purchasi* unless the conditions are suitable for the Coccinellids to breed and increase.

Icerya purchasi, Mask., has two or three generations a year, and is mostly reproduced parthenogenetically. Though the newly hatched larvae seem very active, they can travel only about 12 feet in an hour, so that they cannot migrate to any appreciable extent unless aided by birds or other insects. The dispersion of this scale must therefore be chiefly caused by transportation of infested shoots or fruits. It can withstand starvation to a considerable extent, and newly-hatched larvae live 6 or 7 days, and adults 41 days on an average without food. It is not only very injurious to the fruit by sucking the sap, but also gives rise to a sooty mould on the foliage. Other natural enemies that attack it are *Novius limbatus*, Mots., and *Chrysopa matsumurae*, Akamato, but they are less prolific and are of less practical value.

SCHØYEN (T. H.). **Om Skadeinsekter og Snyltesopp paa Skogstraerne i 1915.** [Report on the Insect and Fungus Pests of Forest Trees in Norway in 1915.]—*Saertryk av Skogdirektörens Inberetning for Kalenderaaret* 1915, *Christiania*, 1917, pp. 154–159, 1 pl.

The larva of *Dendrolimus pini* was sent from Romsdals county, and a full-grown larva of *Lymantria monacha* from near Christiania, this being the third occasion that this moth has been found in Norway. The author calls attention to the possibility of an outbreak of this pest. Spruce cones attacked by *Dioryctria* (*Phycis*) *abietella* were sent from near Christiania. *Enarmonia* (*Grapholitha*) *nanana* and *Eucosma* (*G.*) *tedella*, which were recorded as pests for the first time in 1913, were reported from north Trondhjem county. The larvae of *Lydia* (*Tortrix*) *coniferana* and *Dioryctria abietella* were found in the bark of pine trees on the sites of attack by the fungus, *Dasyscypha calycina*. *Myelophilus piniperda* attacked pine trees that had previously been damaged by sulphurous acid smoke from smelting works. *Anobium abietis* was sent from Gjövik, where it was stated that for some years the ground had been covered by cones attacked by this insect. *Lygaeonematus* (*Nematus*) *erichsoni* was reported from one locality. *Diprion* (*Lophyrus*) *pini* was very numerous in the southern part of the country, thousands of larvae being found on a single tree; young trees were preferably attacked. *Chermes pini*, which is the most destructive pest of young pine trees in the western part of the country, has been reported from several localities. *Chermes abietis*

injured hedges of cultivated spruce trees. *Chermes piceae* was reported from silver spruces at Christiania, and *Lachnus piceae* appeared on a spruce hedge and in a nursery.

Cidaria dilutata, *Cheimatobia brumata* and *Cossus cossus* attacked birch trees. The ravages of *Hyponomeuta euonymellus* in the south-western part of the country has now been going on for four years. Oak leaves were mined by *Tischeria complanella* and *Phyllocnistis suffusella*.

The outbreak of *Galerucella* (*Galeruca*) *lineola*, which began in 1912, appeared to be on the decrease in 1915, but the alders in many districts had been completely destroyed. *Melasoma* (*Lina*) *aeneum*, which occurred in company with *G. lineola* in 1913 in western Norway, appeared in great numbers at Sogn in 1915. *Phyllodecta vitellinae* was reported from some localities and *Drepanosiphum platanoides* was still more abundant on maple in 1915 than in 1914 in the southern and western parts of the country, causing the leaves to drop in July and August. *Eriosoma* (*Schizoneura*) *tremulae* was exceedingly numerous on aspen in many localities.

Schøyen (T. H.). **Beretning over Plantesygdome i Norge 1916.** [Report on Plant Diseases in Norway in 1916].—*Saertryk av Landtbruksdirektörens Aarsberetning for* 1916, *Christiania*, 1917, pp. 37–85.

Severe injury to cereals, caused by wire-worms, was reported from Ostlandet, the cold weather in the early summer retarding the growth of the crops and exposing them to the attacks of the larvae. The larvae of *Tipula oleracea* were reported to have attacked the roots of oats and barley. *Hydrellia griseola*, Fall., also damaged oats, especially in Trondhjem county in July. *Oscinella frit* has been recorded on oats and barley in several localities. *Clinodiplosis mosellarum*, Geh., is now recorded for the first time as injurious in Norway, ears of wheat containing larvae having been found at the beginning of September. *Aphis avenae* was very numerous in many parts of the eastern districts, but probably owing to unfavourable climatic conditions no serious damage was done. The author suggests destroying the bird-cherry trees as a means of dealing with this pest. *Macrosiphum granarium* was reported from oats and barley. Ears damaged by thrips were also recorded. Grasses were attacked by larvae of *Melolontha hippocastani*, *Clidogastra flavipes* and *Pediculoides graminum*.

Clover was injured by *Aptinothrips rufus* and peas by *Kakothrips pisivora* (*Thrips robustus*).

Cabbage was attacked by *Barynotus squamosus* (*schönherri*). This seems to be the only instance where this beetle has done any harm in Europe, whereas in Canada it is a recognised cabbage pest. The larvae of *Ceuthorrhynchus rapae* were found in the stalks of turnips at Stavanger. Other cabbage pests were *Pieris brassicae*, *Barathra brassicae*, *Euxoa* (*Agrotis*) *corticea*, *Tipula oleracea*, and *Phorbia* (*Chortophila*) *brassicae*, of which outbreaks occur periodically. The larvae of *Scaptomyza* sp. were found mining in the leaves of cabbage and turnips. Podurids were found in great numbers on turnips and cabbage, and *Psila rosae* occurred on carrots.

Apple pests included, *Phyllopertha horticola*, *Cantharis obscura* injuring the flowers, *Phyllobius pyri* and *Luperus flavipes*. *Xyleborus dispar* killed young trees in many localities, especially when previously damaged by frost. There seem to be two generations a year, eggs being laid in May and June and in August and September. The foliage was damaged by *Aporia crataegi*, *Episema* (*Diloba*) *coeruleocephala*, *Calocampa vetusta*, and *Cheimatobia brumata*. *Cossus cossus*, *Cydia pomonella*, and *Argyroploce* (*Olethreutes*) *variegana* were also recorded from various localities. *Hyponomeuta variabilis*, which has been very abundant during several years, was reported from the greater part of the southern and eastern part of the country. *Argyresthia conjugella* is doubtless the pest which has caused the greatest loss to the fruit-grower in Norway. *Blastodacna atra* (*putripenella*) occurred in two localities and *Parornix* (*Ornix*) *guttea* and *Lyonetia clerkella* mined the leaves.

The Aphids and Coccids observed on apples included: *Aphis pomi*, *A. crataegi*, *A. sorbi* and *Lepidosaphes ulmi*. *Psylla mali*, as in the previous years, caused much damage, and spraying against this pest is being carried out more extensively every year. It was observed in three infested orchards that the hawthorn-hedges surrounding them were heavily infested by this insect. *Thrips flavus* occurred in great numbers on apple buds, and *Tetranychus telarius* and *Paratetranychus pilosus* were also recorded.

Pests of pears included *Byturus tomentosus*, *Phyllobius pyri*, *Xyleborus dispar*, *Eriocampoides limacina* (*Eriocampa adumbrata*), which defoliated the trees in two localities, and the larvae of an unidentified species of *Nematus*. The Cecidomyids, *Contarinia* (*Diplosis*) *pyricora* and *Perrisia* (*Diplosis*) *pyri*, were also recorded. The young fruits were injured by the nymphs of *Acanthosoma haemorrhoidale*, and this bug was also found on the berries of the mountain ash. *Taeniothrips inconsequens* (*Euthrips pyri*), which was recorded for the first time in Norway in 1914, appeared in two other localities in 1916, and the author calls attentions to the danger of neglecting the control of this serious pest and suggests the use of a nicotine spray three times during the growing period. Leaves injured by the mite, *Eriophyes pyri*, were sent from many localities.

Plums were attacked by *Luperus flavipes*, *Cydia* (*Carpocapsa*) *funebrana*, which partly destroyed these trees in some orchards near Christiania, and *Hoplocampa fulvicornis*, which was recorded from Lier, where the crop was said to have been greatly reduced by this pest during several years. *Aphis pomi* was less abundant than during the two previous years. In July and August plum trees were attacked by *Hyalopterus arundinis* (*pruni*).

On cherries, *Phyllopertha horticola* has been very abundant for some years, and it defoliates the young trees. *Byturus tomentosus* did great injury to the flowers. *Xyleborus dispar* attacked young trees previously injured by frost and hastened their death. Other cherry pests were *Lyonetia clerkella*, *Argyresthia ephippiella*, *Tortrix cerasana*, *Eriocampoides limacina*, *Aphis cerasi* and *Taeniothrips inconsequens*. There is reason to believe that the last-named has done considerably damage for several years, although the real cause was not discovered until 1914.

Gooseberries were attacked by *Pristiphora pallipes* (*Nematus appendiculatus*), *Pteronus* (*Nematus*) *ribesii* and *Eulecanium* (*Lecanium*) *ribis*, and currants by *Rhopalosiphum ribis*, which devastated the plantations in the greater part of the eastern districts, *Eulecanium ribis*, and *Eriophyes ribis*, which infested black currants. Raspberries were attacked by *Phyllopertha horticola*, *Byturus tomentosus*, *Pennisetia* (*Bembecia*) *hylaeiformis*, *Anthonomus rubi*, *Dolycoris baccarum*, and *Tarsonemus fragariae*, which is probably a recent introduction in Norway and seems to be spreading every year.

Vines were attacked by *Pulvinaria* (*Lecanium*) *vitis* and *Tetranychus telarius*. *Sphinx ligustri* was recorded as injuring lilac, and *Euxoa corticea* was reported from several ornamental plants. *Cidaria fulvata* and *Olethreutes variegana* were found on roses. Leaves of chrysanthemum were mined by the larva of *Spilographa artemisiae*, and begonia foliage was damaged by *Thrips flavus* in hot-houses. *Typhlocyba rosae* and *Aphis rosae* were reported from several localities. *Coccus hesperidum* was found on myrtle, and *Saissetia* (*Lecanium*) *haemisphaerica* injured *Asparagus sprengeri*.

TULLGREN (A.). **Apelmärgmalen (*Blastodacna putripenella*, Zell.) ett i vart Land föga beaktat, men tvivelsutan viktigt Skadedjur.** [The Apple Pith Moth, a hitherto unobserved, but undoubtedly important Pest in Sweden.]—*Meddelande* no. 164, *Centralanstaltens för Försöksväsendet på Jordbruksomradet, Stockholm*, Entomologiska Avdelningen, no. 29, 1918, 16 pp., 12 text-figs., 1 plate.

Blastodacna atra, Haw. (*putripenella*, Z.), is a moth that during recent years has been found in many localities in the south of Sweden and seems under conditions favourable to it to be of great importance. The question as to whether *B. hellerella*, Dup., and *B. atra* are identical is as yet undecided. The biological differences between them are, however, great, the former living in the fruits of hawthorn, whereas the larva of the latter lives in the buds of the apple, and it is therefore probable that they are distinct species. The adult, larva and pupa and the damage done are briefly described, and as a remedy the author suggests spraying the trees in early spring with 8–10 per cent. carbolineum emulsion.

TULLGREN (A.). **Lökmalen (*Acrolepia assectella*, Zell.) ett i vart Land ej förut iakttaget Skadedjur på lök.** [The Onion Moth, an injurious Insect not hitherto recorded in Sweden.]—*Meddelande* no. 167, *Centralanstaltens för Försöksväsendet pa Jordbruksomradet, Stockholm*, Entomologiska Avdelningen, no. 30, 1918, 11 pp., 6 text-figs.

Acrolepia assectella, Z., was observed for the first time in Sweden in 1917, having been found injuring chives in Småland. A description is given of the larva, pupa and adult moth, as well as of the damage done. In the attacked plants the larvae of a fly believed to be *Drosophila phalerata*, Mg., were also fouud. The author suggests cutting off the parts attacked and destroying them and spraying with nicotine emulsion (one part to 1,000 parts of water) as a remedial measure.

TRÄGÅRDH (I.). **Oversikt over Skogsinsekternas skadegörelse under ar 1916.** [Review of the Forest Insects of Sweden in 1916.]—*Statens Skogsförsöksanstalt, Stockholm*, Flygblad no. 10, 1918, 28 pp., 13 text-figs.

A collation of the data regarding the injury caused by the pine beetles, *Myelophilus piniperda* and *M. minor*, shows that their attacks were most in evidence in Gävle-Dala and the Eastern and the Southern districts. The common reports that these pine beetles are spreading must not be taken literally; they show however that owing to the thinning of the pine forests, which is practised to a greater degree every year, the facilities for the propagation of these pests have greatly increased. In the southern part of Sweden the injury caused by the beetles, when feeding in the crown of the pine trees, does not seem to imperil the health of the trees, but in the northern part of the country this kind of injury appears to be more dangerous.

Ips typographus and *Pityogenes chalcographus* were most in evidence in Hernösands districts, where 70 per cent. of the reports dealt with these pests, Middle Norrlands, Gävle-Dala and the Eastern district following with about 50 per cent. In many reports the ravages were connected with previous damage of the forests caused by snow and storms. Old trees and those of medium age were preferred, and the attacks did not spread over larger areas than groups of a few hundred trees, the next generation migrating elsewhere in large clouds. There are no data as to the time of swarming or for the time required for the development of one generation, but Kolmodin's investigations showed that in 1914 in Orsa the first generation of *Ips typographus* required about 70 days from the 16th of May to the 24th of July. During the last half of the summer other swarms were observed, and it is therefore reasonable to suppose that in the autumn the larvae of the second generation were full-grown or had even pupated. In the spring of 1915 the spruce bark-beetle was therefore far more numerous than is usually the case. As a rule in the Royal forests attempts have been made to combat the beetle, but many private owners entirely neglect any preventive measures. It therefore seems probable that it may become necessary to adopt legal measures in order to enforce the work necessary to control this pest.

Bupalus piniarius has been reported from several localities. A review of the geographical position of the localities where ravages caused by this moth occurred during the years 1889–1916 elicits the fact that they are nearly all situated in the Eastern part of the country. The annual rainfall decreases gradually from west to east in Sweden and the outbreaks have occurred only in the driest part of the country, which seems to suggest that a low rainfall favours the propagation of this moth. If this assumption were correct, the years prior to an outbreak might be expected to be those of abnormal drought. An analysis of the precipitation over certain periods shows this hypothesis to be accurate, the amount of rainfall in all the cases analysed having decreased by from 15 to 27 per cent. of the normal during 2 or 3 years before the outbreak. The author suggests that the reduced rainfall favours the increase of the moth in that the fungoid diseases that generally attack the hibernating larvae are checked when the soil becomes too dry.

The earlier records of *Diprion* (*Lophyrus*) *pini* and *D.* (*L.*) *sertifer* in Sweden are not reliable and our knowledge of these common species is therefore very insufficient. To judge from the observations made by the author, the eggs of *D. sertifer* hibernate, the larvae appearing early in the summer, whereas the larvae of *D. pini* hibernate in their cocoons and the larvae appear later in the summer. Both species are probably one-brooded in Sweden. The chief outbreaks have occurred in the south of Sweden, south of the line where the mean temperature is 5° C. (41° F.).

GLASER (R. W.). U.S. Bur. Entom. **A Systematic Study of the Organisms distributed under the Name of** *Coccobacillus acridiorum* **d'Hérelle.** *Ann. Entom. Soc. America, Columbus, Ohio*, xi, no. 1, March 1918, pp. 19–42.

As opinions regarding the efficacy of *Coccobacillus acridiorum* in the control of grasshoppers have been very conflicting, the author has undertaken a systematic study of a number of cultures distributed under this name. These proved to represent either different species or varieties of the same species and this fact may explain the contrary views of various investigators, and also demonstrates the need for careful attention to the ordinary principles of bacteriology in entomological work. The various tests that have been made since 1909 with d'Hérelle's *Coccobacillus* and the results arrived at are reviewed. Literature on the subject shows that five out of nine articles report encouraging field results. These successful instances all deal with locusts of the genus *Schistocerca* represented by *S. americana*, *S. paranensis* and *S. peregrina*. The unsuccessful reports deal with such genera as *Dociostaurus* (*Stauronotus*), *Zonocerus*, *Oedaleus*, *Locusta* and *Melanoplus*. It may therefore be that the bacterium is effective against certain species of *Schistocerca*, but is unsuccessful among members of certain other genera. All the investigators reported that the bacteria they used were pathogenic in their laboratory experiments. Certain requirements that d'Hérelle and other workers consider necessary to the rapid spread of the disease on the field include cannibalistic and migratory habits; dense infestation; absence of related bacteria that might have an immunising effect; no excess of normal food; high temperature; and absence of excessive rain. The author adds another essential, namely, the use of the same organism by different investigators.

Four different cultures were received from various sources and carefully studied. These, which all purported to be *Coccobacillus acridiorum*, d'Hérelle, are all re-described in this paper and are contrasted in their actions. The bacterium sent by Dr. Ponce from Honduras seems to be an organism new to bacteriology, and the author has named it *Bacillus poncei*. It is not a *Coccobacillus* at all. It is obvious that different organisms are being distributed under the name of *Coccobacillus acridiorum*, and the author suggests that d'Hérelle should re-describe the organism concerned in his grasshopper epidemic more accurately for the benefit of other workers.

Experiments with *B. poncei* proved this organism to be pathogenic to *Melanoplus femur-rubrum* and *Encoptolophus sordidus*. In most cases, however, attempts to recover the bacillus from the blood, the

alimentary tract, or the faeces failed. The author concludes that insects can develop an immunity that can cope more or less successfully with certain foreign organisms. Experiment also indicates that passage infections performed by using the alimentary tract are hopeless on account of the extensive flora. Blood passages with *B. poncei* were also useless in most cases as the gut ruptured after a short time; blood passages with other bacteria were however found to be possible.

Two cultures received direct from d'Hérelle were labelled respectively Souche Cham and Souche Sidi. Experiments with these showed that Souche Cham is pathogenic to M. *atlantis*, and to *M. bivittatus* and *M. femur-rubrum* in a lesser degree. Passage infections with this culture were possible but no increase in virulence was observed. The blood and muscle tissue of *M. atlantis* can be used for passage infections, but extracts from the stomach or intestines cannot. In food infections the time between inoculation and death is somewhat extended. Both these cultures were quite virulent even when old. Souche Sidi, which represented a strain passed through a series of grasshoppers in Tunisia in 1915, proved less pathogenic to *M. atlantis* and *M. bivittatus* than Souche Cham; no passage infections with this culture were attempted. A large series of field experiments with these two cultures have been instituted in dealing with *M. atlantis*, which is a serious pest in certain regions of Vermont, and should prove good material for these experiments on account of its cannibalistic habits and dense swarms. At least another season is required before conclusions can be drawn from these experiments.

The results of twenty-five experiments in the inoculation of locusts with the various cultures referred to are given.

Cameron (A. E.). **Life-history of the Leaf-eating Crane-fly, *Cylindrotoma splendens*, Doane.**—*Ann. Entom. Soc. America, Columbus, Ohio,* xi, no. 1, March 1918, pp. 67–89, 18 figs.

In April 1917 the author discovered on Vancouver Island a Tipulid larva feeding in large numbers on the leaves of *Trautvetteria grandis* (false bugbane), which grows in damp and shady places. The insects were reared to the adult stage and identified as *Cylindrotoma splendens*, Doane. The species of this genus are peculiar among crane-flies in that the larvae feed openly on bryophytic and spermatophytic plants. Descriptions of the life-history and of all stages of the insect are given.

Garnett (R. T.). **Notes on the Genus *Buprestis*, Linné, in California.**—*Ann. Entom. Soc. America, Columbus, Ohio,* xi, no. 1, March 1918, pp. 90–92.

The species dealt with in this paper include *Buprestis aurulenta*, L., which infests practically all pines, Douglas fir, western red cedar and spruce; *B. laeviventris*, Lec., on yellow, lodgepole, digger and sugar pines; *B. maculiventris* var. *subornata*, Lec., in Douglas fir and on foliage of western yellow pine; *B. maculiventris* var. *rusticorum*, Kirby, in yellow pine, Douglas, alpine and white fir; *B. adjecta*, Lec., in yellow and other alpine pines; and *B. fasciata*, Dej., boring in

Douglas fir. *B. gibbsi*, Lec., on oak, *B. confluens*, Say, on poplars, and *B. connexa*, Horn, on alpine trees such as western yellow pine, are rarely found.

FULTON (B. B.). **Observations on the Life-history and Habits of *Pilophorus walshi*, Uhler.**—*Ann. Entom. Soc. America, Columbus, Ohio*, xi, no. 1, March 1918, pp. 93–96.

The Capsid bug, *Pilophorus walshi*, Uhler, was observed in large numbers in a neglected apple orchard near Geneva, New York. This species bears a close resemblance to a large black ant and also to the nymphs of the Jassid, *Idiocerus provancheri*, Van Duzee, both of which are commonly found on the same trees. The first individuals were found on 5th July, the oldest being then in the 3rd instar. By mid-July all stages of the insect were present, probably owing to a prolonged hatching period. Early in August the greater proportion were adults, and by mid-September they had disappeared entirely from the trees.

It was found that Aphids constitute one of the chief sources of food of this bug, both adults and nymphs being predaceous on them; they occasionally suck the juice from a leaf or stem, though no injury could be detected either to foliage or fruit. It is probable that scale-insects are attacked as well as Aphids, but this is not proved. Experiments with nymphs and adults upon Aphid-infested shoots of *Spiraea* show that *P. walshi*, if present in sufficient numbers, might be an important factor in holding in check the natural rapid increase of these pests.

PACKARD (C. M.). **The Hessian Fly in California.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, vii, no. 4, April 1918, pp. 174–177, 1 fig.

Mayetiola destructor, Say (Hessian fly) causes a loss of many thousand dollars annually to wheat-growers in the San Francisco Bay and coastal counties of California, many crops being reduced by from 5 to 50 per cent. Many farmers do not recognise the presence of this pest, and they are instructed to look for the pupal cases, known as "flaxseeds," and the maggots, which are found between the leaf-sheaths and the stem, just above the plant-crown in young wheat and in more mature wheat just above the joints as well. Injured plants are easily recognised by their dark green appearance and by the absence of central shoot or bud; these plants should be pulled up at once. It is during late winter and early spring that the injury is done to young wheat by the growing larvae, which hatch on the leaves and crawl down between the leaf-sheath and stem to the joint where the "flaxseed" is formed. Summer is passed in this form in the stubble. Practices recommended for controlling the pest include rotation of crops, the planting of wheat or barley in two successive years being avoided; early planting (about 1st December), so that the plants may have a vigorous growth before attacks by the flies begin; and summer cultivation of the stubble. Disking will loosen the stubble and break it down and the use of a spike-tooth harrow after disking will pull the plant-crowns out upon the surface,

where they are exposed directly to the sun and the hot dry air of summer. This should be done in the early summer so as to expose the pupae for as long a period of hot weather as possible. It has been found that 70 to 100 per cent. of the pupae are killed by this treatment of the stubble.

JONES (P. R.). **The Selection of Petroleum Insecticides from the Commercial Point of View.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, vii, no. 4, April 1918, pp. 189–191.

The three chief types of petroleum insecticides are described under the headings of mechanical mixtures, mechanical emulsions and miscible or soluble oils. It is pointed out that owing to the uncertainty in appearance of different insect pests from one season to another, it is nearly always necessary for a manufacturer to make plans ahead and manufacture a certain stock that can be despatched quickly to meet whatever emergency in the nature of insect infestation may arise. Frequently these insecticides when manufactured are not required and have to be held over until the following year. It is always necessary also for the manufacturer to put in an excessive emulsifier in order to overcome hardness in water or carelessness in mixing by the consumer. An oil spray that might be satisfactory in an experiment station, therefore, might not have great commercial possibilities. Petroleum insecticides require more expert field service than any other class, and while miscible oils may be high in initial cost, they have greater efficiency and fewer failures in the field. They also have less tendency to break down on the tree than those of the mechanical emulsion type; they are consequently more efficient and cause less injury to trees if the right oil is used in manufacture and the correct dosage in application. The mechanical type of emulsion can only be used with success locally; but if growers had sufficient entomological and chemical training, or could secure extensive field service from universities, experiment stations or horticultural officers, and were able to buy raw ingredients at a sufficiently low price, mechanical emulsions would certainly be the cheapest kind to use.

GRAY (G. P.). **Wettable Sulfurs.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, vii, no. 4, April 1918, pp. 191–192.

While such solutions of sulphur as the lime-sulphur spray have long been in use, they cannot be used on all plants for fear of injuring the foliage. Dry sulphur, which is less active, has recently been used extensively on plants with delicate foliage, but there are certain objections to its application. When dusted upon crops that are soon to be harvested, the pickers complain of its irritating effect upon the eyes. In windy localities, a great deal of the sulphur applied is apt to be blown off the foliage. In order to obviate this, the dust application is often carried out in the morning while the dew is on the plants; this restricts the operation to a limited time. To overcome these objections, sulphur has been mixed with water and applied as a spray. Sulphur, however, is not easily wetted, and in order to counteract the aversion of sulphur for water, without otherwise modifying its properties, a number of substances such as soap, flour paste, oleic acid, glue, dextrin, diatomaceous earth and others, have

been used in the preparation of commercial sulphur pastes. It is found that a wettable sulphur can easily be made at home with a weak solution of glue. The formula recommended consists of 1½ oz. powdered glue dissolved in 3 U.S. gals. of hot water; to this is added gradually 10 lb. sublimed or powdered sulphur, the whole being rubbed into a smooth paste free from lumps. The paste should be strained into the spray tank through a fine sieve, a stiff brush being found useful for this purpose. Water is then added to make 200 U.S. gals. in all. The most finely divided sulphur obtainable should be used for this work. Tests of this material under field conditions have given very satisfactory results in the control of *Tetranychus telarius* (red spider) on prunes and beans. To avoid injury to foliage, it is advisable not to apply sulphur or sulphur pastes when the temperature exceeds 100° F. So far as is known, the home-made wettable sulphur described and the commercial sulphur pastes may be mixed with any of the usual sprays without alteration of the properties of either.

SMITH (H. S.). **The Pink Bollworm of Cotton.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, vii, no. 4, April 1918, pp. 196–198, 4 figs.

This article has been compiled for the benefit of those interested in cotton culture, and gives an account of *Pectinophora gossypiella*, Saund. (pink bollworm of cotton), which, on account of its recent appearance in Mexico, constitutes a menace to Californian cotton-growers, who are warned against the possibility of its introduction in spite of the strict quarantine regulations that are enforced.

DE ONG (E. R.). **The Potato Tuber Moth.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, vii, no. 4, April 1918, pp. 198–201, 3 figs.

Phthorimaea operculella (potato tuber moth) is the cause of serious damage in California to potatoes both in the field and, more frequently, in storage. It feeds also on wild species of *Solanum* (nightshade), and occasionally on tomatoes and egg-plants. The life-history of the insect is given. Preventive measures are recommended and include the selection of uninfested seed potatoes, and the fumigation of any doubtful ones with carbon bisulphide at the rate of 10 lb. per 1,000 cub. ft. for 48 hours, this treatment being given a second time after an interval of about three weeks. Planting should be at least 5 or 6 inches deep, so that the tubers may develop far enough in the soil to be free from attack. Careful hilling will also protect the tubers. The crop should be dug as soon as mature and should be promptly enclosed in sacks, as potatoes exposed for some six hours in the day-time are almost certain to have some eggs laid on them. If the potatoes are infested when gathered, they should be fumigated in an air-tight bin as described above, and this process should be repeated one or more times at intervals of two weeks, so that larvae that have escaped the first treatment may be destroyed when they come to the surface of the tubers to pupate. Potatoes should be stored in as cool a place as possible. Soaking the sacked potatoes in water

for 24–36 hours has been recommended; considerable loss from decay has however resulted from this method, although it can sometimes be successfully used in dry localities.

SEVERIN (H. H. P.). **Fruit Flies of Economic Importance in California. Currant Fruit Fly (*Epochra canadensis*, Loew).**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, vii, no. 4, April 1918, pp. 201–206, 3 figs.

Epochra canadensis, Lw. (currant fruit fly) is of very widespread occurrence in Canada and the United States, but apparently has not been recorded in any other countries. The native host-plants are the wild northern gooseberry (*Grossularia oxyacanthoides*), the flowering or mountain currant (*Ribes alpinum*), and the wild red currant (*Ribes triste*). The life-history and habits of the insect are described. Eggs of apparently a Hymenopterous parasite were found in the respiratory hole of *E. canadensis* in a gooseberry, but no adequate control by natural enemies has been recorded.

Measures against this pest under garden conditions include the daily collection and destruction of fallen infested fruit. Submerging fruit for two days in water destroys all larvae, and this can then be buried or ploughed into the soil. As the pupal stage is passed in the ground below the bushes, the surface soil to a depth of three inches should be removed. Various poisons placed on the ground to destroy larvae, pupae or adults when emerging were tried without success. Potassium cyanide added to soil containing puparia destroyed the pupae, but resulted in defoliation. Vegetable and petroleum oil traps gave no success. Fowls destroy many puparia under the bushes, and should be allowed access to them after the crop is harvested and in early spring before the fruit is set. An objection is that hens scratch holes in the earth and expose the roots of the bushes. If the crop is left unpicked until August, practically all fruit on the bushes would be free from maggots, though some of it may have suffered from sun-scald. Spraying the foliage both with lead arsenate and dilute molasses, and with sodium arsenite and dilute molasses gave a fair amount of success. The first application should be made when all the gooseberries and most of the currants are set.

MASKEW (F.). **Quarantine Division. Report for the Month of January 1918.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, vii, no. 4, April 1918, pp. 217–218.

The following pests were intercepted during the month of January:— From Florida: *Phomopsis citri* and *Lepidosaphes beckii* on grapefruit. From Hawaii: *Diaspis bromeliae* and *Pseudococcus bromeliae* on pineapples; *Coccus longulus* on betel leaves; Lepidopterous larvae in garlic and Coleopterous larvae in cigars. From Indiana: *Aphis* sp. on roses. From Japan: *Parlatoria pergandei*, *Pseudococcus* sp. on oranges; *Pseudaonidia duplex* on azaleas; *Hemichionaspis aspidistrae* and *Chrysomphalus* sp. on aspidistra; Lepidopterous larvae on pine trees and in dried persimmons; *Ceroplastes rubens*, *Pseudococcus* sp. and borer larvae in persimmon trees and in roots of flowering cherry;

Chionaspis sp. on wistaria; *Aspidiotus* sp. on flowering cherry; *Pseudaonidia paeoniae* on peonies. From Nevada: *Heterodera radicicola* in potatoes. From Central America: *Aspidiotus cyanophylli* on bananas. From Mexico: Weevils in larval and pupal stages in acorns; larvae of *Heliothis (Chloridea) obsoleta* in tomatoes. From Oregon: *Rhizoctonia* on potatoes. From Texas: *Parlatoria pergandei* on grapefruit. From Washington: *Heterodera radicicola* and *Rhizoctonia* on potatoes.

The Orchard. Experiments in Connection with the Destruction of Insect Pests of the Tomato.—*Queensland Agric. Jl., Brisbane*, ix, no. 2, February 1918, pp. 64–67. [Received 10th May 1918.]

Experiments in controlling the tomato moth [*Heliothis obsoleta*] proved lead arsenate to be the most satisfactory insecticide for the purpose. An ordinary kerosene hurricane lamp, set on a tin tray and mounted on an empty fruit-case, as described and illustrated in this paper, was most efficacious as a trap-lantern.

ILLINGWORTH (J. F.) & JARVIS (E.). **Cane Grub Investigation.**—*Queensland Agric. Jl., Brisbane*, ix, no. 2, February 1918, pp. 72–73. [Received 10th May 1918.]

It is stated that in the Meringa region *Lepidiota frenchi* and *L. rothi* are much more in evidence than the commoner cane beetle, *L. albohirta*. These two smaller species emerge in early December and are found abundantly on their feeding trees and on low shrubs, fences, grass, etc. They emerge earlier in the evening than the greyback beetles and are easily collected by hand. Although the occurrence of *L. frenchi* is really biennial, small local emergences are generally noticed each season, when the larvae do great damage to both ratoon and young plant cane. On 5th November several individuals of *Anomala australasiae* were confined in cages and a week later a number of eggs had been deposited that hatched on the 22nd. It is intended to work out the life-history of this Rutelid and of other species affecting cane that have not hitherto been recorded.

The indigenous parasites of root-eating cane beetles are being investigated. Male wasps of *Campsomeris radula* are now emerging from pupae derived from eggs of this species on grubs of *Lepidiota frenchi*. In experimenting with light-traps, it was desired so to simplify them that they might come into common use in cane-growing regions. A very successful type consists of a large pan, about a yard square, with sides about 4 inches high, the light being furnished by an ordinary acetylene lamp. A sheet of glass, 9 in. by 2 feet, attached to the stem of the lamp with a string, is found to give excellent results in heading off the beetles that circle about the flame, landing them in a tray of kerosene-coated water. It is found best to place the pan on the ground, so that the beetles cannot fly beneath it instead of into the trap. The best time to catch *L. albohirta* and *L. frenchi* is just at dark before the beetles reach the feeding trees, though *L. rothi* continues to enter the trap throughout the night.

JARVIS (E.). **Notes on the Habits and Metamorphosis of *Lepidiota frenchi*, Black.**—*Queensland Bur. Sugar Expt. Sta., Brisbane,* Div. Entom. Bull. no. 5, 28th September 1917, 14 pp., 1 plate. [Received 27th May 1918.]

Most of the information contained in this bulletin has been published in a previous paper [see this *Review*, Ser. A, v, p. 496]. The various stages of the beetle are described. Adults begin to appear in December and oviposit from 3 to 5 inches below the ground level. The larvae emerge in about a fortnight, and the larval stage occupies in all probability a year and a half, the whole life-cycle occupying two years. In the laboratory the second stage larvae were observed to consume entirely the roots of sugar-cane plants growing in the breeding cages, and in many cases gnawed holes in the sets.

Insects attacking Paddy in the Galle District.—*Trop. Agriculturist, Peradeniya, Ceylon,* l, no. 3, March 1918, pp. 153–158.

Rice-fields having been reported to be considerably damaged and in some cases totally destroyed by insect infestation, investigation showed that the small Jassid, *Nephotettix bipunctatus*, was probably the pest concerned. The plants attacked turned brown and no grain ripened in them. Heavy rains were said to have terminated the infestation. In 1912 a similar outbreak occurred in another district, the damage on that occasion being attributed mainly to another small Jassid, *Nilaparvata greeni*, although *Nephotettix bipunctatus* was also present in considerable numbers. Many Coccinellid beetles were observed in infested areas, and these, when brought to Peradeniya, were found to be predaceous on *N. bipunctatus* and probably assisted in reducing the outbreak. As this insect flies readily on dark nights, experiments are to be undertaken with a view to the systematic use of light-traps.

Damage by this insect differs from that by *Leptocorisa varicornis* (rice bug), the plants being injured as a whole, whereas the latter injures only the ripening ears.

DE STEFANI (T.). ***Rhynchites bacchus*, a Coleopteron injurious to Apples, Apricots and Plums, in Sicily.**—*Mthly. Bull. Agric. Intell. & Pl. Dis., Rome*, ix, no. 3, March 1918, p. 402. (Abstract from *Nuovi Annali Agricoltura Siciliana, Palermo*, vi, Ser. 6, Part 4, 1917, pp. 178–191.) [Received 10th May 1918.]

Orchards in the province of Palermo are seriously damaged by the Curculionid, *Rhynchites bacchus*, and in a much less degree by other weevils of the same genus, such as *R. giganteus*, *R. auratus* and *R. ruber*. *R. bacchus* attacks apricots and plums, in some cases destroying the whole crop of these fruits in about a week. On apples and apricots the insect lays many eggs, but only one on plums. Having deposited an egg in the plum, it cuts through the peduncle about the middle, causing the fruit that is to feed the larva to fall to the ground. In apples and apricots the peduncle is only partly cut, so that the fruit dries up on the tree, dropping during wind or autumn rain. Damp causes the fruit to soften and decompose, enabling the larvae within

to enter the soil and complete their metamorphosis there. Some of the adults hibernate in sheltered spots, where they remain until the spring and attack the fruit as soon as it has set. From dried-up apples containing larvae of *R. bacchus* two parasitic Hymenoptera emerged in September; these were *Eupelmus degeeri* and an unidentified, and probably new, species of *Syntomaspis*. These were not found abundantly and are believed to be of little importance.

The best method for controlling *R. bacchus* is to collect the fallen fruit each day at the same time in all infested orchards and to pick that which is attacked, but still on the tree. The larvae in this fruit should then be killed. It is suggested that the infested fruit might be boiled and given as food to pigs.

MERCET (R. G.). **Géneros nuevos de Encirtinos de España.** [New Genera of Spanish Encyrtids.]—*Bol. Real. Soc. Esp. Hist., Nat., Madrid*, xviii, nos. 3 & 4, March-April 1918, pp. 234–241, 4 figs.

The author describes the following:—*Rhinoencyrtus malenotti*, gen. et sp. n., taken on Graminaceae and on leaves of *Populus alba*; *Pholidoceras brachyptera*, gen. et. sp. n., on Gramineae, taken in company with *Diversicornia pinicola*, *Ericydnus longicornis* and *Dinocarsis hemiptera*.

HUTSON (J. C.). **The West Indian Mole Cricket or Changa.**—*Agric. News, Barbados,* xvii, nos. 416-417, 6th-20th April 1918, pp. 106–107 & 122, 1 fig.

Scapteriscus vicinus (West Indian mole-cricket) is considered to be the most serious insect pest of general agriculture in Porto Rico, and this or closely related species are pests of vegetable garden crops and of grass lawns in some of the other West Indian islands. This cricket has usually been known in literature under the name *S. didactylus*, but that species is apparently limited in its distribution to parts of South and Central America, while *S. vicinus* has a wider distribution, being found in the south-eastern United States, the West Indies and portions of South America. It is found in light, loamy soils, where it lives in burrows, which it rarely leaves except at night. In a dry season the burrows may be carried to a depth of 12 inches, while in a rainy season they are generally within 4 inches of the surface. A prolonged drought may cause an overland migration of adults and nymphs at night to more favourable ground. *S. vicinus* is primarily a vegetable feeder, rarely eating animal food. It feeds underground on seedlings and young plants, frequently dragging the whole under the soil and devouring it. Tobacco is an important crop that suffers from the cricket in Porto Rico; sugar-cane is also attacked when planted on loose, sandy soil, the germinating seeds being destroyed and the bases of young shoots gnawed through. Most garden crops, such as maize, tomato, cabbage, lettuce and pepper, are severely damaged by *S. vicinus*. Many grasses, of which the favourite are *Paspalum* sp. and *Eleusine indica*, serve as food, as well as any roots encountered during tunnelling.

Eggs are laid in the burrows in a loose heap, generally in a pocket concealed by loose earth, and hatch under laboratory conditions in

about 19 days. The young larvae begin to feed at once and generally moult eight times before attaining the adult stage. Both larvae and adults are cannibals, the earlier-hatched ones devouring later hatching or weaker larvae and eggs. About a year is required for the full development of a generation.

No true parasites have been found, but predaceous enemies include native birds, the most efficient being *Butorides virescens cubanus* (Cuban green heron) and *Falco sparverius loquacula* (Porto-Rican sparrow hawk), the little blue heron, the tick bird and the rain bird. These are all useful in St. Lucia, while in St. Vincent *Buteo antillarum* (chicken hawk) feeds largely on mole-crickets. Fowls are helpful on land that is being cultivated, and pigs also eat the crickets.

Preventive measures include wrapping the roots of seedlings in leaves of *Mammea americana*, or, if this is unobtainable, in cylinders of tin, heavy paper or wire. These devices are expensive and are only used for valuable plants. Repellents include flowers of sulphur and flake naphthaline, but these are not effective in heavy infestations. Remedial measures include ploughing, trap-lights, which are lighted until 10 p.m. in October, November and December, and flooding of the fields so that nymphs and adults come to the surface of the water, where they are generally devoured by such birds as the heron. The most successful control for small areas is a poison-bait of Paris green and flour [see this *Review*, Ser. A, iii, p. 585].

HOOD (J. D.). **A New *Physothrips* from Western Africa (Thysanoptera).**—*Insecutor Inscitiae Menstruus, Washington, D.C.*, vi, nos. 4–6, April-June 1918, p. 116.

Physothrips ventralis, sp. n., is described from numerous specimens of both sexes collected from a large variety of flowers in Southern Nigeria.

BACK (E. A.) & PEMBERTON (C. E.). **The Melon Fly.**—*U.S. Dept. Agric., Washington, D.C.*, Bull. no. 643, 8th March 1918, 32 pp. 23 figs.

This bulletin, dealing with *Dacus* (*Bactrocera*) *cucurbitae* (melon fly), is a revision of an earlier one [see this *Review*, Ser. A, v, p. 448]. Although not yet present in the United States, this fly would do untold damage there if once it became established, and the measures taken to prevent its introduction are described.

BACK (E. A.) & PEMBERTON (C. E.). **The Mediterranean Fruit Fly.**—*U. S. Dept. Agric., Washington, D.C.*, Bull. no. 640, 8th April 1918, 43 pp., 33 figs.

This bulletin has been compiled to give a clear conception of the difficult problem that has arisen from the introduction of *Ceratitis capitata*, Wied. (Mediterranean fruit fly) into the Hawaiian islands. The co-operation of all fruit-growers of the United States is required in order to keep out this pest. The bulletin gives in concentrated form information that has already appeared in a more extensive paper [see this *Review*, Ser. A, vi, p. 184].

SMULYAN (M. T.). U.S. Bur. Entom. **Key and Descriptions for the Separation and Determination of the first Instar Stem Mothers of the Three Species of Aphids most commonly attacking the cultivated Apple.**—*Psyche, Boston, Mass.*, xxv, no. 2, April 1918, pp. 19–23.

A detailed description is given and a key for the identification of the first-instar stem-mothers of the following Aphids:—*Aphis malifoliae*, Fitch. (*A. sorbi*, Kalt., of recent American authors) commonly known as the rosy apple aphis; *A. pomi*, Deg., known as the green apple aphis; and *A. prunifoliae*, Fitch (*A. avenae*, F., of recent American authors), known as the apple-grain aphis. *A. prunifoliae* is the first of the three to begin hatching, and in Virginia may begin as early as the middle of March. The other two species begin about 10 days to 2 weeks later.

ALDRICH (J. M.). **Notes on Diptera.**—*Psyche, Boston, Mass.*, xxv, no. 2, April 1918, pp. 30–35.

In the course of this paper, the author remarks that among the many host-plants of *Agromyza pusilla* (common leaf-miner), he has reared it from mines in leaves of the common milkweed, *Asclepias syriaca*, and has found what is apparently the same larva in leaves of the horsemint, *Monarda punctata*. In the milkweed, the miner feeds in the palisade tissue and does not touch the laticiferous system lower down in the leaf.

FUNKHOUSER (W. D.). **A New Membracid on Cypress. (Homop.).**—*Entom. News, Philadelphia*, xxix, no. 5, May 1918, pp. 185–187, 1 plate.

Stictolobus trilineatus, sp. n., a Membracid infesting cypress in Louisiana is here described.

NEILL (J. W.). **Dry Land Farming.**—*Texas Dept. Agric., Austin*, Bull. no. 52, Proc. 6th Meeting Texas State Farmers' Institute, 1916, p. 104. [Received 15th May 1918.]

In the course of this paper it is pointed out that about 95 per cent. of insect pests spend their winter in the ground in one stage or another. Piles of rubbish, clumps of grass and clods of dirt also shelter numerous beetles and other insects. If all farmers would break up their soil to a depth of 6 inches or more in early autumn or winter, they would destroy insect pests more quickly than any spraying machines can. Since the annual damage to agriculture by insects alone in Texas is estimated to be more than £10,000,000, the advantages of this method of destroying them are obvious.

SCHOLL (—). **The Pink Boll Worm of Cotton.**—*Texas Dept. Agric., Austin*, Bull. no. 57, Proc. 7th Meeting Texas State Farmers' Institute, 1917, pp. 69–70 & pp. 100–101. [Received 15th May 1918.]

An account is given of the pink bollworm of cotton [*Pectinophora gossypiella*] and attention is called to the danger of this pest appearing in the cotton belt of the United States.

A resolution was passed by the meeting demanding appropriate legislation and urging all those in authority to use every effort to prevent the entrance of this pest into Texas.

MERRILL (D. E.). **The Bean Beetle** (*Epilachna corrupta*, **Muls.**).—*New Mexico Agric. Expt. Sta., State College, Las Cruces*, Bull. no. 106, April 1917, 30 pp., 6 figs. [Received 15th May 1918.]

Epilachna corrupta, Muls. (bean beetle) is the most serious bean pest in New Mexico, destroying on an average about 10 per cent. of the crop. The adults hibernate and do not appear on the bean plants until after the first week in June. About a week later they begin ovipositing on the under-sides of leaves, and after an incubation period of 4–9 days the larvae appear and immediately begin to feed, eating off the lower epidermis and the green substance of the central layers of the leaf, until only the upper epidermis and veins remain as a whitish skeleton. Much more damage is done in this way than by the adults, which simply eat holes here and there entirely through the leaves. There are two overlapping broods in a year, first-brood larvae appearing from 19th June to 23rd August and second-brood larvae from 20th July to the end of the season. The maximum damage is therefore done between 20th July and 23rd August when the two larval broods occur simultaneously. The pupal period lasts about 4 days. Adults that survive until the food-supply is gone scatter when the cold weather begins and seek shelter under old vines, weeds or rubbish that may be in or near to the bean fields, and sometimes partly bury themselves in the soft soil beneath.

As beans are the only food-plants, control should be comparatively easy. Clearing the fields of all old plants and rubbish, and ploughing in autumn and winter, will obviously destroy many hibernating adults. Rotation of crops and removing the new fields as far as possible from the old ones will prevent many adults from reaching their food-plants in the spring. Early planting in spring will allow the crop to set and mature before the beetles appear. Very late planting, if practised universally in a community, would cause many beetles to die before finding plants on which to oviposit. A table gives dates for planting in relation to attacks by *E. corrupta*, and shows that the date of planting may be anticipated by one or two weeks at least. Although trap-crops have not been tested experimentally, it is expected that excellent results would be obtained by using a late trap-crop, consisting of a small patch of beans, to attract adult beetles in late summer after the main crop is gathered. Hand-picking is useful on small areas only.

Natural enemies of *E. corrupta* are few, the beetles being protected from attack by a repellent fluid secreted at the leg joints. The Coccinellid, *Hippodamia convergens*, and an ant have been observed eating the eggs, but among all the insects handled during the life-history investigations no parasites were observed.

Sprays tested for control of *E. corrupta* on bean plants included lead arsenate in dust and liquid form, zinc arsenite, sodium arsenite, Blackleaf 40, and combined arsenate of lead and lime-sulphur. These gave varying results; powdered lead arsenate (2 lb. to 50 U.S. gals. water) killed young larvae feeding on the sprayed leaves, but the adults were repelled and would die of starvation rather than eat the

leaves. Lead arsenate dust had much the same effect; zinc arsenite (2 lb. to 50 U.S. gals. water with 2 lb. stone lime) was less adhesive; sodium arsenite killed or damaged the plants. A spray of Blackleaf 40 (1 pint to 100 U.S. gals. water with 4 lb. soap) killed very young larvae when they were hit by it, but had no effect on older stages. Lead arsenate and lime-sulphur combined cleared the plants for two weeks, after which they became re-infested. A fine spray with an angle nozzle is recommended.

In Colorado, only one generation in a year is reported.

Paddock (F. B.). **The Turnip Louse.**—*Texas Agric. Expt. Sta., Austin,* Bull. no. 180, October 1915, 77 pp., 5 plates, 10 figs. [Received 16th May 1918.]

Much of the information contained in this bulletin on *Aphis pseudobrassicae* (turnip aphis) has previously been published elsewhere [see this *Review*, Ser. A, iv, p. 187].

Paddock (F. B.). **The Harlequin Cabbage-Bug.**—*Texas Agric. Expt. Sta., Austin,* Bull. no. 179, October 1915, 9 pp., 1 fig. [Received 16th May 1918].

Murgantia histrionica, Hahn (harlequin cabbage-bug) is found in almost every field and garden in Texas where cabbages are grown, and it also attacks kale, cauliflower, turnip, radish, mustard, rape, and other plants of the mustard family. Entire fields of cabbage may be destroyed in a few days by a severe infestation. The life-history of *M. histrionica* is not fully known. Adults hibernate in any sheltered spot in or near the infested fields, though in the warmer sections of the State the insects may be found feeding in the fields during the greater part of the winter. The adults emerge from their winter quarters in old crop or weed rubbish early in the spring, sometimes as early as 1st March. The first brood is usually found on wild mustard or closely related plants, and oviposition occurs on these plants about 10 days later. These eggs hatch in 4 to 8 days, the nymphs attacking cabbage as soon as it is available. The nymphs cannot fly and their power of migration is therefore limited. It is probable that in the northern part of the State there are two broods in a year and perhaps a partial third; in the central sections of the State there are perhaps three full broods and in the northern sections there may be four generations in a year. Adults that do not lay their eggs before 1st September live through the winter and oviposit in the following spring. With the exception of one parasite of the egg, *M. histrionica* has very few natural enemies.

Preventive and remedial measures have been previously dealt with [see this *Review*, Ser. A, v, pp. 388, 529]. Mustard is recommended as the best trap-crop for this bug.

Merrill (J. H.). **Spraying Fruit Trees.**—*Kansas State Agric. Expt. Sta., Manhattan,* Circ. no. 66, April 1918, 8 pp.

Instructions are given for making lime-sulphur sprays, self-boiled lime-sulphur, dry lime-sulphur, and Bordeaux mixture, with recommendations for applying dormant sprays. Spray schedules are given for apple, pear, peach and plum trees in a series of tables.

MERRILL (J. H.). & MELCHERS (L. E.). **Insects and Plant Diseases attacking Garden Crops.**—*Kansas State Agric. Expt. Sta., Manhattan,* Circ. no. 65, April 1918, 12 pp.

This circular gives in tabular form the various times and materials to be used for the control of insect pests of garden crops and recommends several sprays, solutions for seed treatment and other mixtures.

D'EMMEREZ DE CHARMOY (D.). **Report on the Importation of Scoliid Wasps from Madagascar.**—*Dept. Agric., Mauritius,* December 1917, 5 pp. [Received 17th May 1918.]

In certain parts of Mauritius for some time past considerable damage has been done to growing sugar-cane by *Oryctes tarandus.* Owing to the successful parasitisation of the larvae of *Oryctes* spp. in Madagascar by Scoliids, the experimental importation of these was undertaken in the hope that the partial control of *O. tarandus* might thereby be effected.

Numerous individuals of *Scolia oryctophaga* captured in the province of Tamatave, Madagascar, were liberated in Mauritius where they successfully parasitised *O. tarandus.* Both sexes of this wasp live exclusively on nectar and can reproduce themselves only in localities that afford a supply of blossoms continuously during six to eight months of the year, especially from May to November, this being the period during which the insects occur in the adult form and reproduce. For this reason an adequate supply of suitable nectar-bearing plants should be established on the borders and in the vicinity of cane fields in the districts where it is desired to introduce the parasite. The best plants for this purpose are *Cordia interrupta* and *Urena tomentosa.*

One female wasp is capable of parasitising about 30 larvae of the beetle, the oviposition period extending over about 2 months. The egg hatches in about 5 days and the small larva attaches itself by the mouth-parts to its host. Pupation takes place in a reddish grey cocoon, the adult emerging 6 to 8 weeks later. The male cocoon is much the smaller. The adult insect is very strong on the wing, being capable of covering long distances without fatigue in search of the particular kind of food that suits it.

The Scoliids themselves are attacked by several parasites, the most important of which are Coleoptera belonging to the family RHIPIPHORIDAE, which attack the Scoliid larvae when spinning their cocoon. Their eggs are also subject to attacks by the Gamasid mites that sometimes infest the larvae of *O. tarandus.*

Oryctes in damp localities in Madagascar is attacked by a fungus, which has been introduced into Mauritius and seems capable of assuming a highly infectious character under widely different conditions.

In addition to *S. oryctophaga* other Scoliid wasps introduced from Madagascar were :—*S. caffra, S. iridicolor* and *Elis romandi,* probable parasites of *O. tarandus* ; *Elis pfeifferi,* a probable parasite of *Lachnosterna* ; and *Elis thoracica,* a probable parasite of *Adoretus versutus.*

Parks (T. H.). Planning a State Extension Project in Entomology.—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 2, April 1918, pp. 157–164

The necessity for reducing waste at a time when crop values are very high and food scarce makes the need of extension work in applied entomology greater than ever before. Hitherto this has been done in a sporadic manner and without pre-arranged plans, by members of the Federal Department of Agriculture or State Experiment Station staff, whose advice and help has been sought in times of trouble due to insect outbreaks. The time of these officers being so limited, they have often been unable to formulate and initiate plans to prevent the future occurrence of similar outbreaks. Owing to the small amount of time they could devote to field-work, farming interests have suffered heavily owing to the State agricultural colleges and Federal Department of Agriculture being ignorant of insect injuries then occurring. Extension entomology will now probably take its place along with research and teaching work, the present shortage of food-stuffs having brought about the realisation of its potential usefulness.

The main object to be attained is a reduction in the amount of emergency work to be done, which necessitates a thorough knowledge of state-wide crop conditions and the constant work in anticipation of any threatened insect outbreak. For example the extension entomology workers in Kansas were preparing during the autumn of 1917 for the grasshopper campaign of 1918 by locating and circulating knowledge of the egg-laying places in Western Kansas. This latter was effected by means of exhibits of grasshopper eggs accompanied by information as to their location and directions for their destruction by cultivation, the same plan being followed in control work for the chinch bug [*Blissus leucopterus*].

Extension work must be planned on preventive lines, of which the average general farmer is strangely ignorant in spite of the volumes of literature that have been published. His desire is to interview the active field-worker on his own farm and discuss his own conditions, which makes it necessary that the entomologist should be qualified to speak intelligently on other branches of agriculture and should have farm experience and an agricultural education. Such a visit places the farmer in personal touch with the institution represented by the entomologist, who in his turn leaves practical methods for use under present conditions.

Information is best circulated through the country farm bureau agents who understand local needs and can ensure co-operation in the whole community.

As a preliminary to any plan of extension work, information from all sources likely to be of value must be gathered and systematised, and a yearly programme of work must be drawn up that will be continuous and efficient, in addition to being in advance of emergency calls. The practical knowledge gained by comparing the results of remedial measures under different methods of farm or crop management, furnishes to the farmers convincing proof of the value of applying the best measures of control.

In most localities educational work is needed before demonstrational work can be of any value, and the two should be made continuous

throughout the year. Educational work by means of farm visits, travelling exhibits, lantern-slide lectures and the press, represents the most that can be done with such insects as the Hessian fly [*Mayetiola destructor*] and subterranean species. Farmers' institutes, movable schools, moving pictures and travelling exhibits, are all valuable means of educational work, while newspaper articles, when timely, are also of great value, since they easily reach the greatest number of people.

Demonstration work, such as orchard spraying, admits of pre-arranged planning which can be carried out as scheduled, but that against staple crop insects cannot be anticipated in advance and can be applied only when the pests appear, though definite work for each month from March to December can do much to reduce the injury caused by such outbreaks.

HUNTER (S. J.). **Municipal Control of the Spring Canker Worm.**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 2, April 1918, pp. 164–167.

During the spring of 1916 and 1917 the spring canker worm [*Palaeacrita vernata*] was unusually abundant and destructive in cities of eastern Kansas. In the former year, instructions issued through the press led many property owners to place tanglefoot bands on their elm trees and to renew the tanglefoot or other adhesive substance two or more times. A few kept the bands properly renewed with tanglefoot throughout the spring, but the results were unsatisfactory, since enough caterpillars were bred on the unprotected and partly protected trees to defoliate them and also to reach protected trees by way of the interlocking branches.

The following spring the city commissioners on 23rd January ordered the elm trees to be banded, the cost of the work, when done by the city, being charged to the properties. The city banded 6,000 trees and the property owners 5,000, not one of which died or was defoliated. The tanglefoot was renewed from 10 to 13 times, the cost being from one to three shillings per tree for the season according to size. These renewals necessitated the burning off of the insects on the bands with a blow torch. The bands were kept fresh till 1st May, and it was necessary to do the work thoroughly and persistently as the insects were able to cross the bands if this was neglected.

The use of arsenical sprays against the canker worm in cities is not safe, practical or economical, as it stains the paint on buildings and is washed from roofs into cisterns, while the expense is many times that of banding.

The tar-paper bands used were made by a mattress factory in rolls of twenty-five feet, with a mixture of cotton and jute glued to the under-side. Many adhesive substances were experimentally tried, but none gave such uniformly good results as tanglefoot, by which the moths, as well as the caterpillars that hatched below the bands, were captured on their way up, and those that had previously ascended were caught on their way down.

During the discussion that followed this paper, it was stated the young larvae can be carried by the wind as far as half a mile during the first three days after hatching by means of the delicate threads that they spin. It was also stated that 20 banded trees each showed

as many as 30,000 female moths caught on the band. Experiments with substances that would act as repellents to the female moths, or as insecticides to prevent them crossing the bands, were tried without success.

McConnell (W. R.). *Eupelminus saltator*, Lindm., as a Parasite of the Hessian Fly.—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 2, April 1918, pp. 168–175.

Another parasite, hitherto unrecorded in America, has recently been reared from the Hessian fly [*Mayetiola destructor*]. It has been identified as *Eupelminus saltator*, Lindm., and is probably identical with the parasite reared from the galls of various species of *Isosoma*. The facts concerning the life-history of this parasite are not yet fully known, the biological data collected being based on laboratory experiments during the season of 1916.

The species is probably wide-spread in Europe and was undoubtedly introduced into America at an early date in infested straw. It has been reared from Pennsylvania, Maryland, and Virginia, and from *Isosoma* material in several other States. During these investigations it has not been an abundant parasite of *M. destructor*, only 6·67 per cent of the puparia, at the most, being parasitised by it.

E. saltator is a primary parasite of *M. destructor*, which it attacks externally in both the larval and pupal stages. It may however become a secondary parasite, since a puparium from which an individual had emerged was opened and found to contain cocoons of *Polygnotus*, from one of which it had issued. It has also been reared from the galls of several species of *Isosoma* (*Harmolita*), including *I. tritici*, *I. vaginicola*, *I. maculatum* and *I. albomaculatum*.

The males are as yet unknown. The females, after emergence, rest and feed for about 3 days before beginning oviposition, which may extend over a period of about 24 days. One individual may lay as many as 5 eggs a day to the aggregate number of at least 100, oviposition occurring only during daylight and preferably in bright weather. In two cases, this species has been reared through 5 and 6 parthenogenetic generations. The eggs hatch in about 3 days and the young larvae attach themselves to the host by means of the mandibles. The host dies within 2 or 3 days and the parasites slowly absorbs the body contents, leaving nothing but the empty skin. The larval and pupal stages occupy 8 to 12 days each, and it was found possible to rear six generations in about a year, but in a comparatively cool summer probably not more than three generations are produced. It will be necessary to keep this parasite under observation for a series of years before its real value can be correctly estimated.

Morrill (A. W.). Experiments with Grasshopper Baits with Incidental Observations on the Habits and Destructiveness of the Differential Grasshopper (*Melanoplus differentialis*).—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 2, April 1918, pp. 175–186.

The poisoned bait experiments described in this paper on *Melanoplus differentialis* were carried out in lucerne fields where the grasshoppers were fairly evenly distributed, and at a time when practically

all were in the adult stage. It was found that the activity of the insects made it unusually difficult to conduct field experiments on a small scale, it being necessary to make a liberal allowance for errors and variations and to draw no conclusions except through the grouping of records or from observations repeated several times.

The baits to be tested were prepared in the laboratory and the same tests were conducted simultaneously by two observers working in different fields, observations being made at intervals of fifteen minutes.

The standard mixture was prepared according to the formula: bran 25 lb., 5 lemons, 2 qt. molasses, 1 lb. Paris green and water to make a crumbly mixture, and this was varied by the substitution of oranges, tomatoes and canteloups for oranges, the replacement of bran by sawdust and the omission of molasses.

The results showed that canteloup was the most attractive fruit and lemons the least; that the use of molasses did not increase the effectiveness of the baits; that pine sawdust was much inferior to bran, baits prepared with it being only about half as effective. The bran available in Arizona however contains a large proportion of fine material and the use of ¼ to ½ sawdust gives a mixture that is much easier to distribute in the field.

Observations were also made on the distance that poisoned grasshoppers travel, a fact that it is sometimes important to know, and it was found that none could move more than 27½ yds. from the poisoned plot. *M. differentialis* feeds most actively during the warmer parts of the day and less actively towards night, and similarly the best results from feeding the grasshopper, *Eucoptolophus subgracilis*, Caudell, with poisoned bran mash, were obtained between the hours of 3 p.m. and 3.30 p.m.

Calculations based on the weight of freshly-cut lucerne eaten by adults of *M. differentialis* enclosed in a wire screen cage showed that one individual per square yard may destroy the equivalent of 3 lb. lucerne hay per acre per day. In a 40-acre field a moderate infestation averaging 16⅔ hoppers per yard may destroy the equivalent of 1 ton of lucerne hay per day. It is evidently very profitable therefore to poison these grasshoppers, even when they average as few as 5 per square yard.

FLINT (W. P.). **Suggestions for a New Method of Destroying Chinch-bugs.**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 2, April 1918, pp. 186–188.

The fact that the chinch bug [*Blissus leucopterus*] collects in large numbers on any moist object, or on the ground where water has been spilled, suggests a possible means of control by bait moistened with poisoned water.

Laboratory experiments with bran wetted with sodium arsenite of various strengths gave good results, a high percentage of the insects dying in a few hours. The addition of syrup to the solutions did not have the effect of making them more attractive. During the following spring similar experiments were made in the field, the substances used being wetted with sodium arsenite, lead acetate and sodium cyanide at strengths of from ½ ounce to 2 ounces per U.S. gal. water. The sodium arsenite solutions were not very effective at the strengths used, and they also seemed to have a slightly repellent effect on the

bugs. Solutions of sodium cyanide proved efficacious, but more from the effect of the fumes, than as a stomach poison. Such solutions are too dangerous to be recommended for general use.

The best of the poisons tested was a lead acetate solution, 2 oz. to 1 U.S. gal. water. Fresh maize stalks cut and dried for several days were soaked in this solution and spread on the ground, being covered lightly with straw to prevent rapid drying. At the end of the first day 104 dead bugs were found to the square inch, while at the end of the sixth there were 11, the stalks not having being remoistened in the meantime.

WOLCOTT (G. N.). **An Emergence Response of *Trichogramma minutum*, Riley, to Light.**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 2, April 1918, pp. 205–209.

In 1917 the author collected large numbers of egg-clusters of the sugar-cane moth stalk borer, *Diatraea saccharalis*, F., 62·6 per cent. of which were found to be parasitised by the Chalcid, *Trichogramma minutum*. The number of eggs in the masses varied from 3 to 71. The eggs are creamy white when laid, but turn yellow in a few hours, and orange colour in a couple of days, and just before hatching the dark brown head of the young caterpillar can be seen through the transparent shell. Clusters parasitised by *T. minutum* become black soon after parasitisation and remain this colour even after the emergence of the parasite, owing to the contained black débris, making easy the determination of parasitised eggs and clusters.

The eggs are impartially deposited on any part of either surface of the leaf, but are generally more numerous from the centre to the tip. In the laboratory, experiments to determine the influence of light on emergence were made by enclosing bits of leaves bearing egg-masses in small glass tubes, corked at one end, a plug of cotton wool being placed at the other, to absorb the moisture. Both young larvae of *D. saccharalis* and adults of *T. minutum* were found to be positively phototrophic to a very marked degree.

To determine the emergence response of adults of *T. minutum* to light, the tubes with the corks removed were placed with the open ends turned towards the light, and the adults were counted as they left the tubes, the tubes having previously been kept in the dark in a large tube. They were then left in the window for an hour, being examined again at the end of that time and the escaping *T. minutum* being counted as before, after which they were returned to the dark tube.

The ratio of the total number of adults that had emerged before exposure to light compared with the total number that emerged afterwards, expresses what has been assumed to be the emergence response to light.

It was found that the emergence response was not so strong several days after collection, which may have been due to unnatural conditions of moisture, or to the lessened power of an organism to respond to light when it has received only $\frac{1}{12}$ the normal amount. It was also noted that the emergence response is not as strong in the late morning or afternoon as earlier in the day. In the field emergence has been noted from 7.15 to 8.45 a.m., the normal time of emergence being approximately two hours after sunrise.

BURKE (H. E.). **Notes on Some Southwestern Buprestidae.**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 2, April 1918, pp. 209-211.

The eighteen species of flat-head borers dealt with in this paper were collected from Sabino Canyon, Arizona. Several of the species are of economic importance, as they riddle the wood of the mesquite (*Prosopis glandulosa*) and other south-western shrubs and trees with their larval mines. The majority attack dying or dead trees only, but a few species will kill trees or parts of trees, one, *Melanophila pini-edulis* specially attacking the pinion (*Pinus edulis*).

Those mining in dead and dying wood are: *Psiloptera* sp., *P. webbi*, Lec.; *Chrysobothris octocola*, Lec., which often severely damages posts and piles of mesquite firewood; *C. edwardsi*, Horn; *C. debilis*, Lec.; *C. axillaris*, Horn; *C. ignicollis*, Horn; *C. ludificata*, Horn, the common species on yellow pine slash in northern Arizona; *C. trinervia*, Kirby, which also kills young yellow pine saplings by girdling them close to the ground; *C. breviloba*, Fall, which lays its eggs between the scales of the bark of *Pinus ponderosa* (western yellow pine); *C. exesa*, Lec.; *C. texana*, Lec.; *C. gemmata*, Lec.; *C. merkeli*, Horn; *Actenodes calcarata*, Chev.: *Acmaeodera conoidea*, Fall; *A. larreae*, Fall; and *Tyndaris olneyae*, Skinner.

MCCOLLOCH (J. W.). **Notes on False Wireworms, with especial Reference to *Eleodes tricostata*, Say.**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 2, April 1918, pp. 212-224.

The Tenebrionid genus *Eleodes* (false wireworms) comprises many species that have recently come to be recognised as pests of growing crops. Originally typical of the native prairies, the gradual cultivation of these latter is depriving the insects of their native food and forcing them to feed on the more succulent cultivated crops. The larvae so closely resemble true wireworms that considerable confusion has resulted, much of the injury attributed to the latter, especially in the semi-arid regions, being probably due to false wireworms. The larvae are subterranean, nocturnal in their habits and move with great rapidity through the soil, hence it is often impossible to find them at work without a diligent search.

Records of injuries due to *E. tricostata* are very few, but it has been reported as feeding on the roots of grasses, as doing more damage than cutworms to cabbage and other garden crops, and as being a general feeder on weeds in the field.

In Kansas this species is a pest of the native prairie grasses, but in the laboratory both larvae and adults feed readily on germinating wheat and maize. It is widely distributed throughout the western central States from the Mississippi to the Rocky Mountains and extends northwards into British America.

In studying the life-history, eggs were placed in small tubes closed with cotton plugs and kept in the field insectary under outdoor conditions. On hatching the larvae were placed in tin boxes containing slightly moistened soil and a small amount of bran for food, for which germinating wheat was substituted as they became larger. The soil in the boxes was changed about every ten days in summer, but in winter once in three weeks was sufficient. The adult beetles were

confined in jars, containing about an inch of dry soil and a little bran. All these stages, except the eggs, were kept in a cement cave, where the temperature more nearly approximated to subterranean conditions, varying from 70° to 80° F. in summer, to 40° F. in March. The results obtained in this way closely coincided with the field observations made throughout the year.

The freshly laid eggs are white in colour, but when deposited are coated with a sticky solution which causes a thin layer of soil to adhere to them, making them difficult to find in the field. They are laid preferably in the driest soil, and singly, although several may be placed in the same cavity, which is then filled up with soil. The length of the egg stage varies with the season of the year, but is on an average 14 days, eggs being deposited from the middle of July till the middle of October, 8 being the average number deposited by each emale.

The larva on hatching is creamy white in colour, but after the first moult it changes to black, which colour it retains during the rest of the larval stage. During the summer and autumn the larvae are found from 1 to 6 inches or more below the surface of the ground, burrowing from place to place, and feeding on the roots and seeds of plants, and probably, to some extent, on decaying organic matter. In confinement, they often feed on their cast-off skins and on larvae that have died or are in a weakened condition. The average length of the larval stage is 9½ to 10½ months, and before pupation the larvae enter a semi-pupal stage which lasts from 5 to 10 days, during which they do not feed and are very inactive.

The average length of the pupal stage is from 17 to 19 days, maximum pupation occurring at the beginning of June. Under both field and experiment conditions adults emerge from the middle of June till the middle of July, the maximum emergence occurring about June 24. *E. tricostata* may hibernate as an adult as well as in the larval stage, but eggs have never been obtained from these overwintering beetles. Both in the field and in the rearing cages, feeding, mating and oviposition take place generally at night. During the day-time the beetles are found under rocks, boards, logs and manure, where they are rather inactive, but able to run with great rapidity when the cover is removed. In the field, adults have been found feeding on *Solidago, Euphorbia marginata*, prairie clover and evening primrose. The length of life of the adults is rather more than a year, females usually living longer than males.

The members of this genus are not attacked by many predaceous enemies, probably owing to the fact that the adults of most of the species secrete an oily liquid having a strong offensive odour, when disturbed. Skunks however feed on the beetles, and chickens and crows devour them readily. They have also been found in the stomachs of the crow, blackbird and red-headed woodpecker.

Very few parasites have been found attacking any species of *Eleodes*; but a Braconid parasite, *Perilitus* sp., has been recorded from *E. suturalis*, a Nematode worm from an undetermined adult and a Gregarine, *Stylocephalus giganteus*, from *E. hispilabris*, Say, and *Eleodes* sp. The author has recently found this same Gregarine in the alimentary tract of *E. tricostata* and *E. opaca*. A species of *Sarcophaga* has also been reported larvipositing on *E. tricostata, E. hispilabris,* and

E. obsoleta, Say. A number of Hymenopterous larvae found in one of the cages containing *E. tricostata* proved to be *Perilitus eleodis*, Vier., the same parasite having been reared also from *E. opaca*. This parasite emerges through the anal aperture of the beetle and pupates after spinning a silken cocoon. After an average pupal stage of 9 days the adults emerge and remain close to the ground, trying to get under the beetles in order to oviposit in the abdominal sutures and at the junction of the legs and body. Many parasites may infest a single beetle, as many as 124 larvae having been secured from one individual, though the average number bred from one beetle is 50. Although in some years as much as 50 per cent. of the beetles may be parasitised, the average parasitism seems to be only 5 or 7 per cent.

Most of the species of the genus *Eleodes* reach their greatest abundance in areas of little rainfall, but owing to the wide distribution of *E. tricostata* it is probably not as greatly influenced by moisture conditions as most of the other species. The effect of moisture on the adults of *Eleodes* in general results in the dominant form of sculpturing being determined by seasonal conditions, a hot, dry season producing a large number of the smooth forms, and a cold wet season the more striate and punctured forms.

E. tricostata has not yet become of sufficient economic importance to warrant any extensive control experiments. In the laboratory, poisoned bran gave good results with the adults, but the larvae lived for weeks on this diet. Fallowing and rotation are courses that might, however, be followed with advantage.

Childs (L.). **Seasonal Irregularities of the Codling Moth.**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 2, April 1918, pp. 224–231.

The work of which a résumé is given in this paper has been conducted for the purpose of supplying fruit-growers with information which would enable them to apply lead arsenate sprays more intelligently and satisfactorily. The recommendations issued by some central or distant station in the form of spray bulletins are often useless for the control of *Cydia pomonella* in certain regions of the Pacific North-west, where most diverse conditions exist in a comparatively small area. Variations of temperature, due to altitude, coastal and mountain influences, are such as to warrant seasonal studies of the moth in various localities, such studies being of greater importance in the control of the second generation than of the first, which can generally be effectively controlled by following a prearranged spraying programme.

The necessary data were obtained by the use of breeding cages distributed throughout the valley of the Hood River, Oregon, at different altitudes, commercial apple orchards occurring there at levels of 100 to nearly 2,000 ft. The average seasonal variations in the two extremes given proved to be 15 days to 3 weeks for the first brood, and about 10 days for the second.

That the kind of weather experienced in any particular season is able to influence the date of emergence of both the first and second broods of moths, is very evident from a consideration of that obtaining in the years 1915 to 1917 inclusive. The spring of 1915 began with an early, warm spell that induced the partial emergence of the first

brood moths by 27th April, which however was completely checked by a succeeding long period of cold. The late, cold spring and early summer of 1916 deferred the first appearance of moths till 26th May, similar weather conditions in 1917 checking emergence till a still later date, 15th June.

The appearance of the second brood did not follow uniformly from these dates, but in its turn depended on the kind of weather experienced during the summer months. Thus in 1914 the second brood appeared on 19th July and the first eggs were deposited 8 days later. In 1915 the date was 26th July, and eggs were first noted 14 days later. The wet cold summer of 1916 resulted in very few second brood moths appearing, and those very late, not until 18th August, a large proportion of this generation hibernating as larvae, while the few eggs that were deposited were found about a week after the emergence of the moths. In 1917 a very backward early season accompanied by much rain checked the emergence of the first brood till 15th June, but continued warm settled weather throughout the summer resulted in the appearance of the second brood on 3rd August, followed by oviposition 5 days later.

Lead arsenate sprays remain efficacious after application for 20 days at the most. Egg-hatching usually attains its maximum activity 10 to 12 days after the hatching of the first eggs, and this takes place with uniform regularity 2 or 3 days after deposition. For these reasons a spray should be applied shortly after the first eggs of the second brood have begun to hatch out, the dates recommended for spraying in the years under discussion being 27th July, 1914; 12th August, 1915; 28th August, 1916; and 12th August, 1917, together with an extra spray on 5th September, 1917, owing to the fact that a warm autumn induced hatching to continue till the apple crop was harvested.

As the general practice in the past has been to spray for control of the second generation between 25th July and 1st August, which would have been effective in only one of the above years, the necessity for annual, regional observations is obvious.

Maxson (A. C.). **Some Factors Influencing the Distribution of *Pemphigus betae*, Doane, in Beet Fields.**—*Jl. Econ. Entom., Concord, N.H.* xi, no. 2, April 1918, pp. 231-236.

During 1916 a preliminary field survey was made of the factors determining the dispersion and distribution of *Pemphigus betae* (sugar-beet root-aphis) owing to the annual loss of several hundred thousand pounds sustained by the sugar-beet industry due to its attacks in Colorado. The points chiefly studied were the influence exerted on the degree of infestation by previous crops, by the presence of the winter host (*Populus angustifolia*), and by the time factor.

As regards this last it is certain that the original infestation in all beet fields is due either to the hibernating wingless individuals or to spring migrants from the winter host. That being so, the number of infested beets should not increase after the migration from the winter host ceases, unless the Aphids migrate from beet to beet in the field. Observations have proved this to be the case, the infestation increasing from 68 per cent. to 100 per cent. within a fortnight, owing largely to irrigation.

The results of this survey have proved quite conclusively that rotation of crops is of no value as a means of control of this insect.

The winter-host factor appears to be the most active in the spread of this Aphid in northern Colorado. A comparison of the degree of infestation in all fields of those parts where the narrow-leafed cottonwood trees (*Populus angustifolia*) are most abundant with that in fields where they are relatively few, shows a constant higher degree of infestation in fields within half a mile of these trees.

The heavy infestation of the western, as compared with the eastern portions of the sections surveyed, seems to point to the wind being an active factor in dissemination, since, during early summer, while the heaviest migration of *P. betae* from the winter host is taking place, the prevailing winds of northern Colorado are westerly, and by this means the insects might easily be carried from the mountains many miles out on to the prairies.

BALLOU (H. A.). **The Pink Bollworm** (*Gelechia gossypiella*) **in Egypt.** *Jl. Econ. Entom., Concord, N.H.*, xi, no. 2, April 1918, pp. 236–245.

This paper deals comprehensively with the subject of *Pectinophora* (*Gelechia*) *gossypiella* (pink bollworm) in Egypt, as regards its native home and distribution, food-plants, life-history and habits, and the nature of the injury caused by it [see this *Review*, Ser. A, iv, pp. 232, 277, etc]. Control of the insect in the seed by treatment with hydrocyanic acid gas is not practicable owing to the lack of responsible labour in the cotton ginneries of Egypt, and also to the danger to public health of liberating large quantities of poisonous waste gases in so densely populated a country. Carbon bisulphide also, owing to its highly inflammable and almost explosive character, is not suitable for use in close proximity to cotton ginneries where the atmosphere is laden with fine particles of cotton. The most suitable agent for the destruction of the pink bollworm in cotton seed in Egypt is hot air [see this *Review*, Ser. A, iii, p. 505, iv, pp. 472, 491, vi, p. 42].

The natural enemies of the pink bollworm do not occur in sufficient numbers or at the right time of year to exercise any great degree of control.

The losses due to this pest are enormous, amounting to anything between £(E.)3,600,000 and £(E.)4,800,000 in 1916.

BECKER (G. G.). **Notes on the Woolly Aphis.**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 2, April 1918, pp. 245–255.

This paper records the results of investigations on *Eriosoma lanigerum*, Hausm., which aimed at working out the life-history of this Aphid in the Ozark Mts.; studying the relative immunity of various hosts, and of the relationship of these hosts to the species; studying the immunity of Northern Spy stock to the attacks of this species; and determining whether *E. crataegi*, Oestl., is identical with *E. lanigerum*.

In the Ozarks this Aphid winters on elm in the egg-stage and on the roots of apple, and in wounds, knots and rough places on the trunk above the ground of apple and *Crataegus* as apterous viviparae.

The occurrence of overwintering apterous viviparae above ground on apple or *Crataegus* is uncommon in this latitude, as the Aphids seem unable to withstand the low temperatures.

The life-history of *E. lanigerum* in the Ozarks is the same as that recorded for Maine and for Virginia, except that there are probably more than two generations of apterous viviparae on apple and *Crataegus*, since there is a period of 5 months between the appearance of the first spring migrants and the first autumn ones, and of 4 months between the last spring migrants and the first autumn ones. Experiments with apple-root forms showed that there may be from 6 to 12 generations a year, since the apterous viviparae become active by 1st March and continue so until some time in November.

A marked degree of immunity to *E. lanigerum* has been acquired by the elm, susceptibility to attack seeming to be correlated with backwardness of growth in spring. *Crataegus crusgalli* also exhibits an inherent immunity, and in addition may have a conditional immunity depending upon the season.

Experiments in transferring *Crataegus* Aphids to apple and *vice versa* led to the conclusion that apterous viviparae from apple can establish themselves on *Crataegus*, though not so readily as on apple; and that apterous viviparae from *Crataegus* can become established on apple, though not so readily as those from apple.

It was proved by experiments on apple seedlings that the Northern Spy apple is immune to *E. lanigerum*, and that, when it does become established temporarily, this is due to the fact that the Aphids are exceptionally hardy rather than to the fact that the host is congenial.

The wide range of variation in the antennae of *E. lanigerum* as determined by measurements in 29 cases, indicates that *E. crataegi*, Oestl., is a synonym of *E. lanigerum*, Hausm.

BARBER (G. W.). **On the Life-History of** *Sarcophaga eleodis*, **Aldrich.** —*Jl. Econ. Entom., Concord, N.H.*, xi, no. 2, April 1918, p. 268.

The parasitisation of *Eleodes obsoleta* by *Sarcophaga eleodis* in September in New Mexico is recorded. The beetle was observed to be persistently followed by the fly as it moved over a distance of about 8 ft. On coming to rest the fly settled on its back and larviposited on the posterior tip of the left wing cover. Shortly after the beetle moved the tip of the abdomen, thus exposing the anus, and in the fraction of a second the larva had become active and disappeared within the body of the beetle through the anus.

The infested beetle lived for 13 days, and 2 days later the full-grown larva issued, breaking off the head of the host in so doing. The larva entered the pupal stage in the middle of March and the adult fly emerged at the beginning of April.

TRIMBLE (T. M.). **Brown-tail Moths taken on Importations.**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 2, April 1918, p. 268.

The interception of a complete nest of *Nygmia phaeorrhoea* (*Euproctis chrysorrhoea*) (brown-tail moth) on European mountain ash (*Sorbus aucuparia*) is recorded. In view of the risk of fresh infestation of this dangerous pest, the author urges that Congress should pass a quarantine law to prevent the importation of all nursery stock carrying

destructive pests, this being specially necessary owing to the fact that foreign inspection is likely to be somewhat imperfect during the European war.

CORY (E. N.). **Molasses Sprays for the Control of *Monarthropalpus buxi*, Labon.**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 2, April 1918, p. 269.

The experimental spraying of a boxwood hedge at Baltimore for the control of *Monarthropalpus buxi* (boxwood midge) showed that large numbers of adults were trapped by a spray composed of 4 lb. molasses to 50 U.S. gals. water.

WEBSTER (R. L.). **Notes on a *Spiraea* Leaf-roller.**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 2, April 1918, p. 269.

Olethreutes hemidesma, Z., though not usually recognised as being of any particular economic importance, has been generally common throughout Iowa in 1916 and 1917, doing considerable damage to *Spiraea* in nurseries.

There are evidently two generations in Iowa and Illinois, the larvae being abundant in July and again in late August and September. From insectary records moths emerged from 22nd July to 9th August, the pupal period having an average length of 5–8 days.

HORTON (J. R.). **Control of the Argentine Ant in Orange Groves.**—*U.S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 928, March 1918, 20 pp., 6 figs. [Received 22nd May 1918.]

The Argentine ant (*Iridomyrmex humilis*, Mayr), though an important household pest [see this *Review*, Ser. A, i, p. 325], does not directly cause injury in orange groves, though its presence results in scale-insects and Aphids becoming much more abundant. In California the control of *Pseudococcus citri*, Risso, by its natural enemies is largely prevented by the presence of this ant, which however can be controlled by banding the trees, and by the use of poisoned baits. In Louisiana the ant has had no effect in increasing mealy bugs, which are there held in check by natural enemies, this being true of *Icerya purchasi*, Mask. (fluted scale), *Saissetia oleae*, Bern. (black scale), *Coccus hesperidum*, L. (soft brown scale), *Ceroplastes floridensis*, Comst. (Florida wax scale), and *C. cirripediformis*, Comst. (barnacle scale).

The ant does not attend armoured scales, of which the most destructive to orange trees in Louisiana are *Lepidosaphes beckii*, Newm. (purple scale), *Parlatoria pergandei*, Comst. (chaff scale), *L. gloveri*, Pack. (long scale) and *Chionaspis citri*, Comst. (white scale), but it disturbs their natural enemies and feeds on the eggs of some of them. Hence an orchard that is never sprayed or fumigated may become, after two or three years, heavily infested owing to the presence of the ants.

In Louisiana, owing to the heavy rainfall, permanent control and the ultimate elimination of this ant can be achieved by the destruction of ant colonies in specially constructed traps. These traps

consist of wooden boxes of about one foot in each dimension with a loose gable-shaped roof to exclude the rain. In winter, the traps should be filled with damp, but not wet, stable manure and dry weeds and straw, while in summer, the manure, which is used principally for its heat, may be omitted. These traps, of which there should be at least 25 to the acre of 100 trees, should be set near the trees, one to every other tree in alternate rows, about 4 feet away from the trunk; they should be placed upon a slight elevation. When full of ants and ready for fumigation, the lids should be removed, 2 fluid ounces of carbon bisulphide poured into each and airtight galvanised iron covers slipped on, being banked with soil to retain the gas. An hour's fumigation is sufficient to kill all stages of ants within the traps and in the underlying soil, after which the contents should be spread out on the ground and the traps turned up to air for several hours before resetting. From 5 to 8 fumigations at intervals of about one month will be necessary to reduce the ants to a negligible quantity.

Reinfestation may be prevented by means of barrier ditches, for which purpose drainage ditches may be adapted by clearing them of weeds and providing them with divided bridges which the ants cannot cross.

Although the use of poisoned baits cannot be recommended as a substitute for trapping, they may be employed in special cases, a poisoned syrup being placed in fruit jars, the lids of which have a hole pierced in the centre. The jars should be laid on their sides with a piece of sponge inside to render it easier for the ants to reach the poison. The best mixture consists of 8 lb. granulated sugar dissolved in $\frac{1}{2}$ U.S. gal. cold water, to which is added $4\frac{1}{2}$ oz. chloral hydrate crystals, previously dissolved in a small quantity of water, and about $\frac{1}{2}$ lb. strained honey.

If chloral hydrate cannot be obtained, sodium arsenite may be substituted, the mixture being made by dissolving 62 grains of tartaric acid crystals in $3\frac{1}{2}$ U.S. pints water, to which is then added 8 lb. granulated sugar and the whole boiled until the sugar is dissolved. When cool, 200 grains of sodium arsenite (or 172 grains white arsenic), previously dissolved in $\frac{1}{2}$ U.S. pint hot water and cooled, is added, together with $\frac{1}{2}$ to $\frac{3}{4}$ lb. strained honey. The tartaric acid prevents the souring of the arsenical syrup, which the ants take very slowly.

ANDREWS (E. A.). **Cultural Control.**—*Qtrly. Jl. Scient. Dept. Ind. Tea Assoc., Calcutta*, 1917, part 4, 1918, pp. 120-124. [Received 24th May 1918.]

The author pleads for a fuller utilisation of cultural methods directed against insects in tea gardens. The chief of these is deep hoeing, which is effective, cheap and easy, and which, systematically carried out year by year, destroys the larvae of *Xyleborus fornicatus* (shot-hole borer beetle) in such numbers that the pest becomes comparatively negligible. Hoeing also stimulates the bushes and helps them to resist attacks of *Helopeltis theivora* (tea mosquito), *Tetranychus bioculatus* (red spider), Aphids and thrips. Forking round the bushes also gives good results, especially when all grubs and pupae found are collected by hand.

Other important measures are proper drainage and judicious manuring, great harm having frequently resulted from a too prolonged course of nitrogenous manures, or of those which render the soil too acid.

Careful pruning is of the utmost importance, especially as regards the removal of prunings, for these, if allowed to remain in the bushes, afford cover for pupating caterpillars and also collect moisture, conducing to the growth of mosses and lichens which encourage scale-insects and mites. Dead twigs and branches should always be removed, as they attract borers and termites.

Insect Pests of Tea in Ceylon during 1916.—*Qtrly. Jl. Scient. Dept. Ind. Tea Assoc., Calcutta*, 1917, part 4, 1918, pp. 137–139. [Received 24th May 1918.]

During the year very severe outbreaks of *Homona coffearia* (tea tortrix) occurred in several provinces; *Orgyia postica* (tussock moth) was reported in the caterpillar stage in January and October from two localities in the Central Provinces; *Zeuzera coffeae* was present throughout the year, the caterpillars in one district being heavily parasitised by Braconids which emerged in November. *Xyleborus fornicatus* (shot-hole borer) showed the usual tendency to increase its distribution, but no new districts were invaded. Two other very minute Scolytids were reported from tea, and another species, probably *X. coffeae*, was collected in nurseries.

Other insects were:—PSYCHIDAE (bagworms), *Astycus* sp. (tea weevil), *Arbela quadrinotata* (barking-eating borer), the Fulgorid, *Ricanoptera opaca*, a new pest of tea, *Coccus* (*Lecanium*) *viridis* and *Eriophyes* (*Phytoptus*) *carinatus* (purple mite). PSOCIDAE were present in packed tea, to which they probably gained access before packing or through perforated tea lead, being originally present on the wood of the tea chests.

MASSINI (P. C.). **Método biológico contra las Plagas aplicado al *Oeceticus platensis*, Bicho de Canasto.** [The Biological Method against Pests applied to *Oeceticus platensis* (Bagworm).]—*Anales Soc. Rural Argentina. Buenos Aires*, li, no. 5, July 1917, pp. 373–378, 7 figs. [Received 24th May 1918.]

The Argentine bagworm, *Oeceticus platensis*, occurs very abundantly in the south of Córdoba and the province of Buenos Aires and in the southern parts of Argentina generally, while in the northern provinces, although it is present throughout, its numbers are so small that its effects are scarcely noticeable. While certain parasites, such as *Tetrastichus platensis*, Brèthes, do occur in the southern provinces and have some influence in checking the numbers of this bagworm, their effect is altogether inadequate, as may be seen by the number of acacia and willow trees that are completely defoliated by it.

The author therefore undertook experiments in the introduction into the southern provinces of some of the parasites present in the north. These had proved so efficacious where they occurred that the bagworms had practically ceased to exist there and could not be collected in any quantity.

The plan adopted was to collect numbers of *O. pratensis* from the province of Buenos Aires in the month of December, and transfer them to the northern provinces where they were placed upon low-growing trees, for preference acacias. There they were left for a month or six weeks in order to become parasitised, and were then taken back to the original area of infestation. The parasites, having completed their development in the host, emerged to parasitise fresh bagworms in the infested zone. The possibilities of acclimatisation in this region cannot yet be estimated, but it is hoped that a successful means of control of *O. platensis* has thus been found.

The parasites introduced by this method were *Eurytoma caridei*, Br., *Perissocentrus argentinae*, Crawf., *P. argentinae* var. *caridei*, Br., and *Lindesonium caridei*, Br., detailed descriptions of which are given.

BRÈTHES (J.). **El Piojo del Pino, *Leucaspis pini*, Hartig.** [The Pine Scale, *Leucaspis pini*, Hartig.]—*Anales Soc. Rural Argentina, Buenos Aires*, li, no. 5, July 1917, p. 384, 1 fig. [Received 24th May 1918.]

A branch of pine infested with *Leucaspis pini*, Hart., chiefly in the larval stage, is recorded from the south of the province of Buenos Aires. A description is given of the larva, which apparently has not been previously recorded. It is not known whether there is more than one generation a year. While such parasites as *Aphelinus* spp. probably play some part in the control of this scale, nothing definite is known on this point. The best insecticide has proved to be a petroleum emulsion, 4 parts black soap to 15 parts water, adding gradually 10 parts petroleum until an emulsion is formed. This mixture, diluted with 15 to 20 parts water, is used as a fine spray.

BARBARÁ (B.). **Valor del *Coccobacillus acridiorum*, d'Hérelle, para destruir la Langosta.** [Value of *Coccobacillus acridiorum*, d'Hérelle, in the Destruction of Locusts.]—*Anales Soc. Rural Argentina, Buenos Aires*, li, no. 5, July 1917, pp. 385–387. [Received 24th May 1918.]

This paper records the investigations undertaken by the Argentine Commission to determine the value of *Coccobacillus acridiorum*, d'Hérelle, in the destruction of locust swarms. The conclusions reached are that this organism, even with a highly increased virulence, cannot produce a general epizootic by the pulverisation method. It is found normally in the intestines of healthy locusts, and from healthy insects is virulent in abdominal injections, being effective in 24 hours, but infection does not occur by ingestion. The results arrived at by other workers on this subject are also mentioned. The question has been more fully dealt with in another paper [see this *Review*, Ser, A, vi, p. 177].

BRÈTHES (J.). **El Bicho moro, (*Epicauta adspersa*, *Epicauta atomaria*). El Pequeño Escarabajo negro (*Dyscinetus gagates*, Burm.).** [The Meloid beetles, *Epicauta adspersa* and *E. atomaria*. The small, black, injurious Beetle, *Dyscinetus gagates*, Burm.].—*Anales Soc. Rural Argentina, Buenos Aires*, li, no. 8, October 1917, pp. 591–601, 2 plates, 1 fig. [Received 24th May 1918.]

The adults of the Meloid beetle, *Epicauta adspersa*, oviposit in

fields such as potato fields underneath clods of earth, in any small hollow that will serve as a protection to their young. After depositing the majority of her eggs within such a cavity, the female advances towards the opening of the retreat, leaving the last of them close to the entrance. The primary larvae hatch in about 23 days. While seeking suitable food for those that were kept in the laboratory, they were left for more than 20 days without nourishment, without apparently suffering any inconvenience. It is well known that the primary larvae of various Meloids feed on the eggs of locusts. That of *Epicauta vittata* is found in the nests of *Melanoplus* (*Caloptenus*) *differentialis* and *M.* (*C.*) *spretus*, and that of *Mylabris schreiberi* in the nests of *Dociostaurus* (*Stauronotus*) *maroccanus*. *E. adspersa* was found experimentally to attack the oothecae of locusts, such as *Schistocerca* (*Dichroplus*) *vittigera*, and in view of the fact that this Meloid is always more abundant in the years following locust invasions, it seems possible that it may also be an enemy of *Schistocerca paranensis*. It is hoped that this point may soon be elucidated. The chief aim of the first stage larva is to reach the eggs of locusts or grasshoppers, and having obtained a sufficient supply of food from this source, metamorphosis to the second stage occurs in 4 or 5 days. When the larva has exhausted the supply of locust eggs, it burrows deeper into the earth to complete its successive transformations. It lives as a pseudopupa throughout the winter and reappears in the following spring as a fairly active larva, transforming after a few days into a true pupa, the adult beetle emerging a week later. The pseudopupa may however live for two years or more without undergoing any change; this phenomenon has not yet been explained.

E. adspersa is known to be injurious in the adult stage, but is certainly beneficial during its larval period, especially if it should prove destructive to the eggs of *Schistocerca paranensis*. Wherever possible, the adults should therefore be driven by means of smudge fires from fields where they may do damage. If it is necessary to destroy them, copper arsenate appears to be the best material for the purpose.

The therapeutic properties of this insect have been studied since 1855, and it is believed that it would prove a good substitute for the well-known European cantharidin. Adults should be collected in the morning or evening, when they are least active, by shaking the plants over a sack.

Dyscinetus gagates, Burm., has appeared for the first time for several years in wheat fields in numbers that constitute a serious infestation. The beetles bite the young plant exactly at the ground level, quickly causing them to wither and die. The damage done by the larva is greater still, as the insect lives in this stage for three years at least underground, where it feeds on plant roots. It is suggested that the infested ground should be ploughed and that domestic birds should be allowed access to the ploughed land. For the adults, Bordeaux mixture or arsenical sprays are suggested.

BRÈTHES (J.). **Los Pulgones de las Plantas.** [Plant Aphids.]—*Anales Soc. Rural Argentina, Buenos Aires*, li, no. 9, November 1917, pp. 666–668, 1 fig. [Received 24th May 1918].

This paper gives a popular and general account of Aphids and their habits. The species occurring in Argentina are not yet definitely

identified. Various enemies, such as the larvae of Coccinellids, Chrysopids, Syrphids and certain species of *Aphidius*, are known to exercise some control over them and the author is studying this group of Braconids with the object of effecting an interchange of parasites. As an insecticide for use against Aphids, Bordeaux mixture is suggested.

BRÈTHES (J.). **Description d'un Mimaridae (Hyménoptères) nouveau du Chili.** [Description of new Chilian Mymarid (Hymenoptera).] · *Rev. Chilena Hist. Nat., Santiago de Chile*, xxi, no. 3, 30th June 1917, pp. 82–84, 1 plate. [Received 31st May 1918].

While it might be expected that Chili would contain representatives of all the families of Hymenoptera, no Mymarid has previously been observed west of the Andes. The author describes in this paper *Anagrus, porteri*, sp. n., from a single example taken near Santiago in 1916.

LICHTENSTEIN (J. L.) & PICARD (F.). **Biologie des** ***Pristaulacus*****, Kieffer [Hym. Evaniidae] et leur Répartition en France.** [Biology of *Pristaulacus*, Kieffer, and its Distribution in France.]—*Bull. Soc. Entom. de France, Paris*, no. 5, 13th March 1918, pp. 109–111. [Received 27th May 1918.]

Very little is known of the habits of the Evaniids, *Pristaulacus* spp., and of the species found in France. *P. patrati*, Serv., *P. latreillanus*, Nees, and *P. gloriator*, F., have been previously recorded; to these the authors add *P. bimaculatus*, Kieff., *P. schlettereri*, Kieff., and *P. chlapocskii*, Kieff. The last-named emerged in July and, less abundantly, in August and September, from branches of fig, evergreen oak and willow, all of which were infested with *Clytus pilosus*, Först. (*glabromaculatus*, Goeze). It therefore seems, as far as is known, to be an exclusive parasite of this Longicorn. *P. bimaculatus* is recorded as having been reared from *Purpuricenus koehleri*, and it is considered probable that *P. schlettereri* is also a parasite of Longicorns. *P. patrati* is known to be a parasite of *Xiphydria*. It is not known whether one species can attack both Coleoptera and xylophagous Hymenoptera, though indications rather point to the contrary.

KEILIN (D.). **Sur quelques Modes particuliers de Résistance des Larves de Diptères contre la Desiccation.** [Some special Means of Resistance to Desiccation shown by Dipterous Larvae.]—*Bull. Soc. Entom. de France, Paris*, no. 5, 13th March, 1918, pp. 102–104.

The method of resistance to desiccation shown by Dipterous larvae varies in the different groups. Larvae of *Ceroplatus* protect themselves by spinning a coarse web made by a salivary secretion of the mouth; under this the larval and nymphal stages are passed. Moisture is obtained during these stages by rubbing against the hydroscopic threads of the web, which absorb moisture from the air. If removed from under the web, the larvae either begin at once to spin a fresh one, or die by desiccation. Larvae of Mycetophilids and Sciophilids are protected in a similar manner. The larvae of *Phronia* sp., which often accompany *Ceroplatus tipuloides*, F., secrete a thick

salivary liquid that coats over the whole body and to which particles of excrement adhere and provide a protection against desiccation. Larvae of *Sciara militaris* and other species of this genus are frequently found clustered so close together as to form a solid mass covered by a salivary secretion. By this means the surface of evaporation is considerably decreased and the larvae escape desiccation in spite of a particularly thin cuticle. Larvae of *Forcipomyia corticis*, and other Ceratopogonids that generally live under the bark of more or less diseased trees, have special hairs on the body that are particularly sensitive to moisture in the air, which condenses on them in small drops. The larvae of certain Tipulids possess hypodermic glands that secrete an oily substance, which forms a coating over the fine hairs covering the body and produces a characteristic iridescent appearance. This protects them at the same time from sudden submersion in a too liquid environment and from desiccation by too rapid evaporation. This is the case with *Epiphragma ocellaris*, which constructs galleries in dead and dried wood. The larvae of aphidivorous Syrphids, which live on the plants and are often exposed to a hot sun, are protected by an abundant salivary secretion that covers the larvae and helps them not only to cling to the plant, but to capture their prey.

FEYTAUD (J.). **Le Ver des Pommes** (*Carpocapsa pomonella*, **Linné.**) [Codling Moth, *Cydia pomonella*, L.].—*Progrès Agric. Vitic., Montpellier*, xxxv, no. 13, 31st March 1918, pp. 299–304.

This paper gives a popular account of the biology of *Cydia pomonella* (codling moth), the nature and extent of the injuries it inflicts and the methods of control that have proved most successful. The cost of treatment with lead arsenate spray is discussed and the relative values of treated and untreated crops are compared. While the profits accruing from unsprayed trees are so small as to be hardly worth considering, the net profit per tree sprayed once on the 8th May proved to be 9*s*., on those sprayed once on the 26th May it was 2*s*. 6*d*. per tree, and on those treated on both of these dates it was 13*s*. per tree.

FEYTAUD (J.). **Notes sur la Piéride du Chou.** [Notes on the Cabbage Butterfly.]—*Bull. Soc. Etude Vulg. Zool. Agric., Bordeaux*, xvii, no. 5, May 1918, pp. 33–38.

During a serious infestation of *Pieris brassicae*, L. (cabbage butterfly) in the south of France in October 1917, the author made some tests of the control measures generally recommended. Dusting the caterpillars heavily with ordinary flour seemed to have no effect upon them; wood ash or quick-lime used in the same way were also without effect, but in the open, with the dew falling, they gave good results, more than half the caterpillars dying. Hot water tests were also made. Water at 122° to 131° F. is known to kill the larvae, but this is difficult to apply without the necessary apparatus. The addition to the water of a small quantity (1 per cent.) of black soap or white olive-oil soap greatly increased its efficacy; almost all the caterpillars were killed with this spray, maintained at a temperature of 122° F. for 5 seconds. The action of these hot soap solutions on the plants remains to be investigated. When the plants are treated a month or so before maturity, or in young plantations, it would be much

simpler to apply a cold solution of black soap (5 per cent.) and nicotine (1 to $1\frac{1}{2}$ per cent. of titrated extract). This is a very active insecticide applied directly to the larvae, and very effective as a preventive spray during the oviposition period. These treatments are recommended in view of the prohibition against arsenicals such as are used in America. Fowls are frequently suggested as a help in clearing off the caterpillars, but several cases of poisoning have occurred as a result of their eating the insects. For small areas, the surest, safest and most economical way is to inspect the cabbages every 2 or 3 days during the oviposition period and crush the groups of eggs of *P. brassicae*, or collect and crush the young larvae.

FEYTAUD (J.). **Le Procès du Moineau Domestique.** [The Case of the Domestic Sparrow.]—*Bull. Soc. Etude Vulg. Zool. Agric., Bordeaux*, xvii, nos. 3-4, March-April 1918, pp. 31-32 & no. 5, May 1918, pp. 41-47.

The author gathers together in this paper many and varied opinions of naturalists and others regarding the economic status of the domestic sparrow. While some regard this bird solely as a pest and recommend its destruction, others aver that it is at least as beneficial as it is harmful, and advise its protection. In the author's opinion, the position of this bird must remain doubtful. He considers that the sparrow is noxious or beneficial according to circumstances, and that while in normal times it may be given the benefit of the doubt, it should nevertheless be watched, and if the cultural circumstances of the region or of the moment, or an excessive increase in the numbers of the birds, should render it noxious, steps should at once be taken to check its depredations. While the swallow, tomtit and nightingale can be classed without hesitation as useful birds that should be protected by active propaganda and by the law, and while the sparrow-hawk, the great horned owl and magpie can at once be condemned as harmful, it is not possible to place the sparrow permanently in either of these categories. It merits some protection as being sometimes beneficial, and the question is raised as to the means by which too prolific an increase of it should be checked. In Alsace-Lorraine it is the custom to keep down sparrows by preparing trap-nests for them on the walls of houses; the sparrows readily build there and the young are destroyed in the nests. Whatever the means employed, sparrows should be held in check, but care should be taken not to exterminate them.

LEGISLATION.

Order relative to the Black Weevil Borer of Bananas.—*Jamaica Gaz. Extraordinary*, 11th May 1918.

By this order, the proclamation is revoked which ordered the destruction by fire or otherwise of banana and plantain plants or parts of plants infested with the black weevil borer [*Cosmopolites sordidus*]. [See this *Review*, Ser. A, iv, p. 320].

GODARD (A.). **Utilité ou Nocuité des Principales Espèces d'Oiseaux indigènes.** [The Utility or Noxiousness of the Principal Species of Indigenous Birds.]—*Bull. Soc. Etude Vulg. Zool. Agric., Bordeaux,* xvii, no. 5, May 1918, pp. 39–41.

This paper consists of a résumé of the author's booklet, *Les Oiseaux nécessaires.* It is pointed out that the objection to such a résumé is that the facts are affirmed without any proofs, but, in reply to numerous requests, the information is given in tabulated form under various headings according to the degree of utility or noxiousness of the many species of birds considered. Advice is given as to the protection or destruction of each species.

COLEMAN (L. C.) & KANNAN (K. K.). **Some Scale Insect Pests of Coffee in South India.**—*Mysore Dept. Agric., Bangalore,* Entom. Ser. Bull. no. 4, 1918, 66 pp., 4 plates, 17 text-figs. [Received 28th May 1918.]

The most important of the several species of Coccids attacking coffee in south India are *Coccus viridis,* Green, *Saissetia hemisphaerica,* Targ., and *Pulvinaria psidii,* Mask.

Since the first appearance of *Coccus viridis* in Ceylon in 1882, coffee-growing has been abandoned in that island, while it has been recorded from almost every other coffee-growing country of the world. From Ceylon the pest soon spread to South India, but was not reported from Mysore until 1913. This scale is liable to variation and has changed so much since its appearance in Mysore that Green's description no longer applies to it. The Mysore form is therefore regarded as a new species, and is here described as new under the name *Coccus colemani.*

The life-cycle varies from 89 to 214 days and the number of young from 50 to 580, this species having greater reproductive powers than *C. viridis.* There are three moults in the nymphal period, each instar of which is described. Records of the life-history are given in tables.

The relationship of ants to this scale is discussed. *C. colemani* is visited by a number of different species of ants, but there is apparently no record of the scales being protected by any of these. This question has been studied in Java, where it was found that *C. viridis* was able to live and multiply for a long period without being visited by ants at all. *Oecophylla smaragdina* was found to aid development of the scale and protect it from enemies, while *Plagiolepis longipes* and *Dolichoderus bituberculatus* have both been considered to have a marked influence in increasing its numbers on coffee trees [see this *Review,* Ser. A, v, pp. 274, 573]. The authors made experiments to determine whether ants play any rôle in the spread of this pest. It is obvious from the results of these that those species that feed on the honey dew have a large share in its distribution, and that their nests must be regarded as distributing centres. The nests also appear to be convenient shelters during adverse weather. Nests of *Cremastogaster* in coffee estates were found crowded with the scales in September, while elsewhere they could be detected only after careful search or not at all. In the case of two blocks of about four acres each, equally infested with *C. colemani,* all ants' nests were removed

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from one block, while in the other they were left undisturbed. After seven months they were again inspected and it was found that in the block where there were no ant nests only 8 trees were infested with the scale, while in another block there were 132 trees infested. In tests to determine the possible protection from parasites afforded by the ant, it was found that on infested plants on which an ants' nest had been placed, no parasitised scales were found, while on plants without ants many scales were parasitised. These experiments are not considered conclusive, but it is significant that the only estate in which *C. colemani* seems to have obtained a persistent hold in Mysore is one where *Plagiolepis longipes* is found abundantly.

The most important insect enemies of *C. colemani* in Mysore are Hymenopterous parasites that oviposit in the body of the host, though the scale continues to live and even to reproduce in spite of their presence. Hyper-parasites and ants check the activities of these parasites to a serious extent; very few of the species concerned have been identified, though text-figures are given of several of them. Certain Coccinellid beetles are more or less predaceous on this scale, the most promising of these being *Chilocorus nigritus*. These beetles lay eggs on the stem under the scaly bark or on the under-side of the leaf. They hatch in about a week, and the larvae moult three times before pupation, which occurs after about 20 days; adults emerge a few days later. Both adults and larvae feed on the scale, one larva consuming on an average eight individuals in a day. If, therefore, this enemy could be introduced in sufficient numbers it should prove an efficient check. Minute mites destroy many of the nymphs while they remain beneath the mother; their reproductive power is great, but their numbers vary greatly with the locality and the season. The most serious checks to the increase of *C. colemani* are two fungi. *Cephalosporium lecanii* (white fungus) frequently kills off more than 90 per cent. of the Coccids on coffee estates during normal rainfalls. *Empusa lecanii* (grey or black fungus) is usually found attacking the scale throughout the early part of the cold weather season, and may continue active until May. While the white fungus is chiefly dependent on wind and rain for its dispersal, the spores of the black fungus are often projected a distance of one or two inches, thus enabling it to spread even during the drier seasons.

The host-plants on which *C. colemani* have been found in Mysore include *Albizzia* spp., *Wrightia tinctoria*, *Aegle marmelos* (bael fruit), *Artocarpus integrifolia* (jak-fruit), *Mangifera indica* (mango), *Psidium guayava* (guava), *Citrus* spp., *Ficus* spp., and *Eugenia jambolana*. The pest is most abundant in years when the north-east monsoon is scanty and a long period of dry weather succeeds it. Dispersion is largely effected by wind, the young insects being blown as far as 450 feet. When artificial methods of control are necessary, spraying and brushing are recommended. The best insecticide is the fish-oil resin soap prepared and sold by the Madras Fisheries Department, used at the rate of 1 lb. to 2 gals. water; this should be applied with a pressure sprayer. All nests of ants should be destroyed. Dispersion of the fungi should be encouraged by tying branches containing them to trees that are free from them. Rapid surface evaporation in young coffee should be prevented by planting a cover crop and by the proper selection of shade trees.

Saissetia (Lecanium) hemisphaerica, Targ., is of universal occurrence in the tropics and has long been known as a pest of coffee in South India, though it has never been regarded as a serious pest of important crops. The life-history is very similar to that of *Coccus viridis*, but it lays eggs instead of bringing forth young. There are a number of Hymenopterous parasites attacking this scale, as well as a fly, the maggots of which feed on the eggs. The larva of a moth, *Eublemma* sp., also destroys the eggs. None of these however is an efficient check. It is very seldom that artificial control is necessary for this scale; in such cases spraying should be as for *C. colemani*.

Pulvinaria psidii, Mask., occurs on a variety of hosts besides coffee. There is considerable variation in the Mysore form from Maskell's description. The life-history is completed in 2 or 3 months; eggs are usually laid on the leaves and the young take from 50 to 70 days to reach maturity. If necessary, this scale should be sprayed in the same manner as *C. colemani*.

ILLINGWORTH (J. F.) & JARVIS (E.). **Cane Grub Investigations.**—*Queensland Agric. Jl., Brisbane*, ix, no. 3, March 1918, pp. 115-116. [Received 30th May 1918.]

Continuing their report on cane grub investigation [see this *Review*, Ser. A, vi, p. 294] the authors suggest that, as the Moreton Bay ash is evidently a preferred food of the grey-back beetle [*Lepidiota albohirta*], these trees should all be cut down within a circumference of about a mile of the cane-fields. They appear to be a favourite food also of both *Lepidiota frenchi* and *L. rothei*. These beetles are frequently found as far as half a mile back into the forest, and would probably travel double that distance to reach their feeding-trees. It is thought that they would probably not return to the cane-fields to lay their eggs, but would deposit them at the roots of native grasses in the forest, as was their habit before sugar-cane was introduced. Trap-trees might be kept near the buildings on each farm and the beetles shaken off each morning and given to the fowls; the weeping fig is recommended for this purpose. Beetles so collected should be quickly dried before being used as food for any animals.

Fields infested with grubs of *L. frenchi* and *L. rothei* have been swarming with parasitic wasps for more than a month, and a high mortality among the grubs has resulted. Experiments with poisons in these fields also gave good results; sodium arsenate mixed with megass and applied in a furrow along the sides of infested stools apparently killed all the grubs in the section treated. Repellents gave only negative results, while any roots that came in contact with creosote fumes were killed and the plants showed a decided yellowing.

Scoliid parasites are being bred with much success; the life-histories of *Dielis formosus* and *Campsomeris radula* are being worked out. The latter parasite deposits a single egg on each grub of *L. frenchi*, and this hatches in about 3 days, the newly-hatched larva immediately beginning to feed on its host. After 9 days the larva reaches maturity and, withdrawing from the body of the host, spins a cocoon and pupates. The pupal stage lasts 39 days for female wasps and 36 for males. The adults, while usually attacking third-stage grubs of

L. frenchi, will also oviposit upon second-stage grubs, but apparently will not attack third-stage grubs of *Dasygnathus australis*. The males of both *C. radula* and *D. formosus* are much more in evidence on the wing than the females, and frequently congregate in numbers at sundown on dead twigs, where they can be collected in handfuls; the females can be unearthed, together with the paralysed grubs, beneath infested stools.

LOUNSBURY (C. P.) & FAURE (J. C.). **Codling Moth.**—*Union S. Africa Dept. Agric., Pretoria,* Local Series no. 22, 1918, 24 pp., 10 figs.

This account of *Cydia pomonella* (codling moth) is written for the information of fruit-growers in those portions of the Union of South Africa that have recently become infested with this pest. The fruits attacked in South Africa, besides apple and pear, include quinces, peaches, plums and apricots, and, even more seriously, walnuts. Parasites of *C. pomonella* in South Africa include three native species of Hymenoptera, reared from the larvae. A fourth larval parasite, known as the Spanish codling-moth parasite [*Calliephialtes messor*], was introduced about 10 years ago, but does not appear to have become established. An egg-parasite, which probably occurs throughout South Africa, seems to be a more effective check than all the larval parasites together, and this is most efficient where codling moth and allied larvae occur regularly and abundantly, that is, chiefly along the south and east coasts. The least help is obtained from parasites in the open country, where there is little other food than codling moth and where many predaceous insects and birds occur. This egg-parasite is a powerful check on the second and third generations of *C. pomonella*, but not on the first one of the season. Predaceous enemies of *C. pomonella* include the Argentine ant [*Iridomyrmex humilis*]; in one locality where this ant is prevalent, the codling moth has occurred for a long time without at any time doing much damage.

Care should be taken at the packing houses, where many larvae leave the fruit to pupate, that these insects are not allowed to complete their development and return to the orchards. After the fruit has been disposed of, the packing house should be inspected and any pupae found there destroyed. Preventive measures include the banding of trees, various methods being described, and spraying. For early sprays that are applied as soon as most of the petals are off, $2\frac{1}{2}$ lb. lead arsenate 50 per cent. paste (or $1\frac{1}{4}$ lb. powder) to 50 gals. water is recommended. The poison must be lodged in the blossom-end of each fruit. For late spraying 2 lb. of the paste or 1 lb. of powder should be used to 50 gals. water. After the early applications spraying should be continued every three weeks, or, for the minimum number of sprayings, the development of the insect must be watched and the applications timed accordingly. One application is necessary just before the caterpillars of the second generation begin to do serious damage and another about 7 or 8 weeks later against the third generation. Another spraying is advisable 2 or 3 weeks after the early spraying of the blossom-ends. If the most favourable times are chosen, four sprayings for mid-season fruit and five for late fruit are as many as are required.

LOUNSBURY (C. P.). **The Phoracantha Beetle. A Borer Pest of Eucalyptus Trees.** *Union S. Africa Dept. Agric., Div. Entom.* [*sine loco*], Local Series no. 24, 10 pp., 2 figs. [Received 30th May 1918.]

Phoracantha semipunctata is a native of Australia, where it is known as a firewood beetle, and was probably introduced into S. Africa in newly-cut railway sleepers shortly before the South African War. It closely resembles in appearance and habits *P. recurva*, Newm., the commoner Australian species, which, so far as is known, has not become established in South Africa. The damage done by this borer is of a secondary nature, as it attacks newly felled timber from which the bark has not been removed, and sickly or dying trees. Dry wood, even though there is bark adhering, is not attacked.

A native South African Cerambycid beetle, *Phryneta spinator*, attacks fig and willow trees and has become confused with *Phoracantha semipunctata.* The eggs of the latter beetle are laid in crevices of the bark in large groups. The young larvae tunnel through the bark to the cambium and then burrow in all directions between the bark and the wood, a form of injury which, if it surrounds the trunk, results in the death of the tree. The full-grown larvae remain in their burrows throughout the winter and pupate as soon as the weather becomes warm. After a short pupal stage the adults emerge and continue to do so throughout the summer.

Most, if not all kinds of eucalyptus trees are liable to attack, though *Eucalyptus globulus* appears to be damaged more often than others. This may be however because it is the most frequently planted species, attempts often being made to grow it in localities that are unsuitable, the resulting unhealthy trees being readily attacked. *E. viminalis* has suffered severely in places, and other species that become infested are *E. longifolia, E. robusta, E. saligna, E. acmenoides*, and *E. diversicolor.* Vigorous trees when attacked exude gum, which is usually fatal to the insects, besides betraying the points of entrance. Unhealthy trees are attacked quite irrespective of their age, the beetles however tending to avoid smooth bark.

In its native country this beetle has important parasitic enemies, but they do not occur in South Africa, and attempts cannot be made to introduce them till shipping facilities again become normal.

Remedial measures include proper drainage and cultivation and protection from fire, though little can be done to keep up the vigour of the trees by these means. Keeping down the numbers of the beetles may be effected chiefly by the use of trap-trees, by keeping the wood in water, by stripping off the bark, and by utilising infested wood promptly, of which the last is by far the most important remedy. Trap-trees are simply trees of little value that are felled and left lying so as to attract beetles about to oviposit away from standing trees. At the end of the summer the traps are dealt with so as to destroy the larvae, and if this is neglected, the use of such traps intensifies the trouble instead of reducing it. Submersion of logs until they are required for use may be profitably employed if they are situated near a dam, but experience has shown that though the larvae between the wood and bark are killed, those more than an inch within the wood were unaffected.

The stripping of the bark from newly-felled trees at once kills actively feeding larvae, since they require the protection of the bark, but those that have finished feeding and have penetrated into the solid wood are unaffected by this measure. Infested trees that are not seriously weakened by the presence of the larvae should be at once utilised as mine props, or for the making of charcoal, or as firewood.

MOORE (J. B.). **The Cattleya Fly.**—*New Jersey Agric. Expt. Sta., New Brunswick*, Bull. no. 308, 2nd October 1916, 12 pp., 2 plates. [Received 30th May 1918.]

Isosoma orchidearum, Westw. (cattleya fly), which has been imported into New Jersey from South America, is the most serious enemy of certain species of orchids. The growing of seedling orchids has not proved practicable commercially and each plant must therefore be imported, consequently the presence of this Chalcid, which weakens and frequently destroys the plants, is of the greatest importance. Very little has been known of the life-history of the pest, and while still incomplete, the author's investigations have added considerably to that knowledge. The egg is laid under the epidermis, usually of the pseudo-bulb or young leaf-buds, and occasionally of the leaves and of the rhizomes. It seems likely that only those eggs mature that are deposited in growths less than a year old. The length of the various stages in the life-history are not known, but the time required from oviposition to emergence is at least 3 months in winter, probably from 4 to 6 months would be more correct, but this period varies greatly with the temperature.

The larvae injure the plant by burrowing out a cavity in the interior of the young buds or pseudo-bulbs, and feeding on the soft tissue. As soon as the burrow is made the growth of the plant is weakened, so that for 2 or 3 years it produces very poor blooms or none at all. Several larvae may be present in the same pseudo-bulb, in which case the cavities may join up and as many as 10 larvae may be in the same cavity. The plant swells up in the vicinity of the cavity and by this means the injury can be recognised. The larvae pupate in the cavity, the adults emerging by gnawing a small circular hole through the epidermis. The intensity of sunlight and the temperature of the house greatly influence the time of emergence and oviposition. Emergence usually occurs on a warm, sunny day and may then be followed by oviposition on the day following, while a few cool, cloudy days would delay the process, or check the rate of oviposition. In less than one day after emergence the insects may have infested a dozen or more healthy plants. The adults live only 4 or 5 days and during this time one female probably lays rather more than 50 eggs. Very vigorous plants are perhaps somewhat immune from attack, as the quick growth of the bud crushes the larvae inside. Some varieties of *Cattleya* are more susceptible to attacks by *I. orchidearum* than others; *Cattleya mossiae* and *C. gaskelliana* suffer very few injuries, while *C. labiata*, *C. percivaliana*, *C. gigas* and *C. trianae* are badly affected.

The remedial measures that have been recommended for *I. orchidearum* include fumigation, spraying, injection of insecticide into the infested portions and destruction of the infested parts. Fumigation

can only be used against the adults, since the other stages of the insect are protected by the epidermis of the plant. Control of the adult is useless, unless it can be killed before the eggs are deposited. Since the female frequently lays eggs on the day of emergence, fumigation is necessary every night from October to April. Experiments have been conducted to find a material for fumigation that will kill or prevent oviposition by the insect and yet can be used every night without injury to the plant. Pyrethrum and nicofume were tried, but were not strong enough; one sheet of nicofume in 600 cub. ft. of space did not prevent oviposition, and it is doubtful whether the plants would stand a stronger dose on 180 consecutive nights. Hydrocyanic acid gas is considered too dangerous for such frequent exposure in the moist atmosphere of an orchid house. Further investigation with fumigants is necessary. Spraying also would reach only the adult, and as it must be applied with the same strength and frequency as fumigation it is not thought to be practicable. At present, therefore, neither of these methods is recommended. Injections of ether, chloroform, carbon bisulphide, nicotine solution and pure air have all been tried in infested growths. The first three named killed both insect and infested part of the plant. Nicotine solution is satisfactory when put into the cavity with the insects, but will not permeate the plant tissues. Simple piercing of the shoot, that is, the injection of pure air into the cavity, kills the insects. Piercing the swollen portion would therefore be satisfactory if it were possible to discover all infestations and pierce them properly. The destruction of infested parts is the oldest and surest method of control known, but has the disadvantage that the infestations are not all discovered. It is best to examine all growths less than 18 months old at least once a week unless the grower has not imported orchids or has had no infestations for a year or longer. All the infested portions should be removed and burned. New importations should be carefully kept in a separate house until they have been known to be free from *I. orchidearum* for at least a year. If a very valuable plant becomes infested and it is not desirable to remove the infested growth, the plant should be quarantined.

Robson (R.). **The Shortage of Clover Seed in Essex in 1917.**—*Jl. Bd. Agric.. London*, xxv, no. 2, May 1918, pp. 176–179.

The shortage of clover seed in Essex in 1917 was in part due to the absence of bees to pollinate the flowers, the Isle of Wight disease having killed off the majority of these, and in part to the destruction of the seed by insects. In 1917, beans, peas and clover were all much eaten by beetles of the genus *Sitones*, which eat the leaves. A more serious pest was the weevil, *Apion apricans*, Hbst. This weevil oviposits in the flowers, and when the clover is cut the young weevils in the larval stage are stacked with it, and these in a few days give rise to adult weevils that issue from the stacks and eat up the first clover plants they encounter and then pass on into the field to lay eggs for the next generation. The heads of clover in which these eggs are laid produce few or no seeds. Cloth bands coated with coal-tar and pitch, placed round the stacks, catch a great many weevils, and a trench with water and tar would undoubtedly trap the majority.

LICHTENSTEIN (J. L.) & PICARD (F.). **Etude Morphologique et Biologique du** *Sycosoter lavagnei*, **Picard et J. L. Licht., Hecabolide parasite de l'***Hypoborus ficus*, **Ev.** [A Morphological and Biological Study of *Sycosoter lavagnei*, Picard & J. L. Licht., a Hecabolid Parasite of *Hypoborus ficus*.]—*Bull. Biol. France et Belgique, Paris*, li, no. 4, 15th December 1917, pp. 440–474, 33 figs. [Received 28th May 1918.]

The small Scolytid, *Hypoborus ficus*, Er., which mines irregular galleries in the inner surface of the bark of fig-trees, is parasitised by a Braconid, *Sycosoter lavagnei*.

The damage done by *H. ficus*, though not in itself of great importance, can hardly be regarded as negligible, owing to the fact of this insect producing three, or perhaps more, annual generations. It is however parasitised by two Chalcidids, though to a less extent than by *S. lavagnei*, and is also destroyed by an Acarid, *Pediculoides ventricosus*, Newp., and by the Coleopterous larvae of *Laemophloeus hypobori*, Perris, *L. ater*, Oliv., and *Nemosoma elongatum*, L.

S. lavagnei, exhibits a seasonal dimorphism in both sexes, most closely analogous to that met with in *Isosoma tritici*, Fitch, and *I. grande*, Riley, the difference between the two generations in this case being attributed to the difference between the succulent nourishment of spring and the drier character of that of summer, though the factor of nourishment in this species can be only a secondary one among several others.

The adults begin to appear in April and emerge throughout the season till the beginning of November. There are probably three generations, the females of the spring generation being almost always winged, while the autumn ones are wingless. Winged males are always exceptional, even in the spring. After emergence, the adult has never been observed to take food, and pairing in observed cases has always been between apterous individuals, once only between an apterous male and a winged female. The egg is laid externally on any part of the skin of the host-larva, which is attacked at any age. On hatching the larva pierces the skin of the host and gradually sucks it dry, ultimately replacing the host larva in its gallery, where it spins its cocoon, the metamorphosis being completed rapidly.

MALLOCH (J. R.). **A Partial Key to Species of the Genus** *Agromyza* **(Diptera).**—*Canadian Entomologist, London, Ont.*, l, nos. 3-4, March-April 1918, pp. 76-80 & 130-132.

The contents of this paper are indicated by its title. The following new North American species are described: *Agromyza deceptiva*, *A. angulicornis*, *A. assimilis* and *A. indecora*.

FISHER (W. S.). **A New** *Hoplia* **from Florida.**—*Canadian Entomologist, London, Ont.*, L., no. 4, April 1918, pp. 140–142.

Hoplia floridana, sp. n., is described from Florida, where this beetle is reported as feeding on citrus foliage.

GIBSON (A.). **The Pea Weevil.**—*Canada Dept. Agric., Ottawa*, Crop Protection Leaflet no. 9, March 1918, 2 pp., 1 fig. [Received 5th June 1918.]

Bruchus pisorum, L. (pea bruchus) has increased to an important extent in Ontario during recent years and has also appeared in a few localities in British Columbia. The eggs are laid on the pods and hatch after a few days, the young larva eating through the pod and attacking the seed, in which the insect remains throughout the larval and pupal stages; the mature beetle also frequently remains in the seed until the following year. When very numerous, however, the adults may leave the peas in late summer or autumn and hibernate beneath rubbish or in barns and other outbuildings. These return to pea plants while the pods are forming, and those planted with the seed emerge through the soil and also fly to pea-pods to oviposit. All growers are urged to watch for the appearance of any stage of the insect and are warned against sowing infested seed unless it has first been fumigated. For this purpose, carbon bisulphide should be used in the proportion of 1 lb. to every 100 bushels of seed; the exposure should last 48 hours in an air-tight bin or other receptacle. This should be done directly after the crop is gathered. *B. pisorum* does not breed in dry seeds; consequently, if the seed is kept in tight bags for a year, any beetles present will emerge and die. For small growers this is an effective protection. Another method of destroying the beetles in the seed is by pouring about half a gallon of coal-oil over a barrel containing about 5 bushels. If every seed can be drenched the oil will penetrate and kill the weevil. If seeds that are used in sowing are found to contain this pest, they should be immersed in scalding water for about a minute and subsequently cooled by pouring cold water over them.

SANDERS (G. E.). **Arsenate of Lime (Calcium Arsenate).**—*Canada Dept. Agric., Ottawa*, Crop Protection Leaflet no. 10, [n. d.], 4 pp. [Received 5th June 1918.]

Calcium arsenate, on account of its efficiency and low cost, is highly recommended as an insecticide, as it replaces lead arsenate or lead or zinc arsenite, which are at present costly and difficult to procure. It is however advisable in the present state of investigations to use it as a spray only for apple, potato and pear; for tender foliage, such as plum, cherry or peach, it is not regarded as safe. Used alone, it causes scorching and must therefore be combined with certain other sprays.

The form in which it is recommended is the commercial dry powder, containing 40 per cent. arsenic oxide in the form of tri-calcium arsenate and less than 1 per cent. soluble arsenic, and so finely ground that 1 lb. of the dry material occupies 80 cubic inches. When 10 parts of either water-slaked or hydrated lime is used to 1 part calcium arsenate, the material can be applied to apple and potato foliage without injury. Calcium arsenate with lime-sulphur has invariably given slightly better results in the control of fungous diseases than lead arsenate with lime-sulphur. Trees sprayed with the former combination have in three years' experiments given more apples

than those treated with the latter mixture. Calcium arsenate with lime-sulphur has caused noticeable yellowing of the foliage; this can be eliminated by adding 5 lb. of water-slaked or hydrated lime to each 40 gals. of the mixture when used for the after-blossom sprayings.

With such sulphide sprays as lime-sulphur, barium tetra-sulphide and sodium sulphides, calcium arsenate is the only poison on the market that can be used without such chemical change taking place between the sulphide and the poison as would result in injury to foliage. On account of the apparent increase in the toxic value of arsenicals that results from the presence of sodium salts, it has been found desirable to decrease the amount of calcium arsenate used with sulphide sprays to the proportion of ½ lb. calcium arsenate to 40 gals. Sodium sulphide solutions do not adequately protect calcium arsenate against air, and in order to eliminate scorching where this combination is used for the four sprays, 10 lb. hydrated or water-slaked lime must be added to each 40 gals.

With Bordeaux mixture, calcium arsenate has given great satisfaction. While lead arsenate, on account of its adhesive qualities, assists the fungicidal action of Bordeaux mixture more than calcium arsenate, the difference in cost and greater convenience are both in favour of the latter material. It is estimated that at the present time Paris green and lead arsenate cost about two-thirds more than calcium arsenate, while zinc arsenite costs about one-third more. Buyers are warned against certain brands of calcium arsenate that are coarse and gritty and low in arsenic, as these give bad results with sulphide sprays.

Ross (W. A.). **Some Ladybird Beetles destructive to Plant Lice.**—*Agric. Gaz. Canada, Ottawa*, v, no. 4, April 1918, pp. 344-347, 2 figs.

Among the Canadian Coccinellids that are of great importance in the control of Aphids are:- *Adalia bipunctata, Coccinella quinquenotata, C. novemnotata, C. trifasciata, Hippodamia tredecimpunctata, H. convergens, Megilla maculata*, and *Anatis quinquedecimpunctata*.

Swaine (J. M.) & Sanders (G. E.). **The White-marked Tussock Moth and its Control on Shade Trees and Orchard Trees.**—*Canada Dept. Agric., Entom. Branch, Ottawa*, Circ. no. 11, 7th March 1918, 12 pp., 9 figs. [Received 6th June 1918.]

This comprehensive circular deals with *Hemerocampa leucostigma*, S. & A. (white-marked tussock moth), an account of which has already appeared [see this *Review*, Ser. A, v, p. 174]. To control this pest in the larval stage on shade-trees lead arsenate spray, at the rate of 5 to 15 lb. lead arsenate paste to 100 gals. water, is recommended. At the time of hatching 5 lb. paste in 100 gals. water will kill the caterpillars; if they are more than a few days old, 10 lb. will be required; while 15 lb. to the same volume of water must be used if they are one-third grown.

At intervals of from 7 to 10 years this insect appears in Canada as an orchard pest. From early July till mid-August the larvae

feed on apples, damaging sometimes as much as 50 per cent. by biting long, narrow, irregular channels that heal with a brown, corky scab. Experience has shown that the best results are obtained from the third or after-blossom spray, even the residue of a spray applied two weeks before the emergence of the larvae being of more value in poisoning the larvae than one applied at full strength two days after their emergence.

In orchards for the spray immediately after the blossoms the following are recommended:—(1) Standard lead arsenate paste 12 lb. to 15 lb. to 100 gals. water; no fungicide is required, the arsenate at this strength being itself efficient for this purpose. (2) Sodium sulphide (soluble sulphur 3 to $3\frac{1}{2}$ lb., Sulphocide, 2 to $2\frac{1}{2}$ quarts, Spra sulphur 3lb.), calcium arsenate $1\frac{1}{4}$ lb. (in serious outbreaks $1\frac{1}{2}$ to 2 lb.), hydrated or water-slaked lime 20 to 25 lb., water 100 gals. (3) Lime-sulphur 1·006 sp. gr., or 2 gals. commercial concentrate to 100 gals. water, and calcium arsenate $1\frac{1}{2}$ to 2 lb. to 100 gals. In applying lime-sulphur for the third spray, the under-side of the leaves should not be wetted.

Cameron (A. E.) & Treherne (R. C.). **The Pear Thrips (*Taeniothrips inconsequens*, Uzel) and its Control in British Columbia.**—*Canada Dept. Agric. Entom. Branch, Ottawa*, Bull. no. 15, 8th May 1918, 51 pp., 22 figs.

A notice of the subject-matter of this bulletin has already appeared [see this *Review*, Ser. A, v, p. 70].

Bezzi (M.). **Notes on the Ethiopian Fruit-Flies of the Family Trypaneidae, other than *Dacus* (S.L.) (Dipt.). II.**—*Bull. Entom. Research, London*, ix, part 1, May 1918, pp. 13–46, 1 plate, 3 figs.

This is the second of the author's papers on this subject [see this *Review*, Ser. A, vi, p. 208], and synoptic tables are given for all the genera and species.

The new species described in this paper include *Ocnerioxa woodi*, from Nyasaland; *Tephritis* (*Urophora*) *vernoniicola*, from Eritrea, bred from galls on twigs of *Vernonia abyssinica*; *Aciura semiangusta* and *A. tetrachaeta*, from Rhodesia; *Tephrella rufiventris* and *Eutretosoma millepunctatum*, from Eritrea; *Spathulina acrosticta*, *Euaresta* (*Pliomelaena*) *brevifrons*, and *E.* (*P.*) *strictifrons*, from Durban; *Ensina siphonina*, from British East Africa; *Euribia perpallida* and *E. discipulchra*, from Nyasaland; *E. tristrigata*, from Eritrea; *Campiglossa perspicillata*, from Durban; *Camaromyia acrophthalma*, from Nyasaland; *Trypanea hexapoda*, from the Gold Coast; and *T. urophora*, from Durban.

Tothill (J. D.). **Some New Species of Tachinidae from India.**—*Bull. Entom. Research, London*, ix, part 1, May 1918, pp. 47–60, 16 figs.

The new species described in this paper include *Gymnochaeta immsi*, *Servillia transversa*, *S. ursinoidea*, *Gonia himalensis*, *Paraphania fuscipennis*, *Chaetoplagia asiatica*, *Frontina kashmiri* and *Lophosia excisa*.

Bagnall (R. S.). **On Two Species of** ***Physothrips*** **(Thysanoptera) injurious to Tea in India.**—*Bull. Entom. Research, London,* ix, part 1, May 1918, pp. 61–64, 2 figs.

The author describes *Physothrips setiventris,* sp. n., and *P. lefroyi,* Bagn., both of which have been found on tea in India in sufficient numbers to be regarded as pests.

Bagnall (R. S.). **On the Rubber Thrips (*****Physothrips funtumiae,*** **Bagn.) and its Allies.**—*Bull. Entom. Research, London,* ix, part 1, May 1918, pp. 65–70, 3 figs.

Three species belonging to the genus *Physothrips* are described in this paper with a key to the characters of each sex. These are:—*P. marshalli,* sp. n., from the Gold Coast, found in the flowers of a variety of plants; *Physothrips funtumiae,* Bagn. (rubber thrips) from Uganda and Southern Nigeria; and *P. kellyanus,* Bagn., from Queensland and Victoria.

Distant (W. L.). **Descriptions of some Capsidae from the Belgian Congo.**—*Bull. Entom. Research, London,* ix, part 1, May 1918, pp. 71–73, 3 figs.

The following Capsids are described: *Lycidocoris mimeticus,* Reut. & Popp., found on coffee bushes and also occurring in Uganda; *L. modestus,* sp. n., on cinchona; *L. thoracicus,* sp. n.; *Chamus bellus,* sp. n.; *C. tuberculatus,* sp. n., on guava.

Trägårdh (I.). **On a New Method of ascertaining the Parasites of the respective Host-Insects in a Mixed Infestation.**—*Bull. Entom. Research, London,* ix, part 1, May 1918, pp. 75–79, 5 figs.

This paper elucidates a method of determining the position of the parasites of the various hosts that constitute the often complicated fauna of such material as the cones of coniferous trees, where each cone usually contains two or three different injurious species.

The cones were kept in breeding-cages and the insects emerging from them were collected daily. Diagrams were then made illustrating the percentage of each species that emerged during each day. It was assumed that a certain relation existed between the time of emergence of the host and its parasite, the latter being adapted both morphologically and biologically to its host and appearing invariably at the moment most suitable for its successful propagation.

Certain data already existed as to the relation of *Nemeritis cremastoides,* Hlmg., *Ephialtes glabratus,* Ratz., and *Bracon* sp. to *Cydia* (*Laspeyresia*) *strobilella,* L. [see this *Review,* Ser. A, vi, p. 90]. It was presumed that if other parasitic species grouped themselves round one or other of the phytophagous species in a similar manner to these species about their host, it might safely be concluded that they were parasitic upon them. Fortunately the various phytophagous species did not appear contemporaneously, but in a certain succession, so that it was possible to ascertain the grouping of the parasites around their hosts. Diagrams illustrating the curves of emergence of the various species demonstrate the relations between host and

parasite. The close relation of the curves of *Platygaster contorticornis*, Ratz., and *Perrisia strobi*, Winn., indicated strongly that the former is parasitic upon the latter, and in fact, investigation of material from which a great number of both these species had emerged revealed a dead individual of *Platygaster contorticornis* in an inflated larval skin of *Perrisia strobi*. It is similarly concluded that *Aprostocetus strobilanae* is a parasite of *Torymus azureus*, but the evidence of this method alone is not considered conclusive, and it should be followed by close investigation of the material collected. It is suggested that this method might be applied in similar difficult investigations, such as in large galls, where many different species occur, and in tree-trunks.

TURNER (R. E.). **On Braconidae parasitic on *Diatraea saccharalis* in Demerara.**—*Bull. Entom. Research, London*, ix, part 1, May 1918, pp. 81–82.

Three species of Braconids have now been bred in Demerara from the larva of the cane-boring moth, *Diatraea saccharalis*, viz. :—*Ipobracon grenadensis*, Ashm., *I. saccharalis*, sp. n., and *Microdus diatraeae*, sp. n., the two latter being here described.

WILLIAMS (C. B.). **The Sugar-cane Froghopper in Grenada.**—*Bull. Entom. Research, London*, ix, part 1, May 1918, pp. 83–87.

A severe outbreak of froghoppers, which proved to be *Tomaspis saccharina*, Dist., a species that has not previously been reported outside Trinidad, is recorded from Grenada. The sugar-cane industry in Grenada is of secondary importance, so that the outbreak is much less serious than in Trinidad. At the beginning of December 1916, the froghoppers were found widely distributed over the Island on grass in cane-fields and by the roadside. The species had evidently been long established. Of three infested fields examined, one had been for ten years previously alternately planted with sugar-canes and used as pasture and before that had been a pasture, the other two had been pastures for 8 years and had only been put under sugar-cane in January 1916. The attack was similar to those in Trinidad ; cane leaves turned brown from the tops downward ; the adult insects were numerous in the axils of the leaves, and nymphs round the main stems. Canes that had been heavily limed round the stools and then earthed up 4 or 5 inches showed comparatively fewer nymphs.

While in Trinidad it is usually the low-lying, heavy clay soils in which damage from froghoppers is most severe, in Grenada such fields remained undamaged, though some froghoppers were found, while the damage was most severe in fields at an altitude of 300–400 ft. on a steep slope facing east and exposed to trade winds. The reason for this difference is not known ; no constant difference could be found between the froghoppers examined in Grenada and *T. saccharina*, Dist., from Trinidad. No maggots of the Trinidad Syrphid fly, *Salpingogaster nigra*, which exercises a considerable check in Trinidad, were seen, nor was the green muscardine fungus, *Metarrhizium anisopliae*, common enough to be of any practical value. Attid spiders, another Trinidad check, were scarce among the canes. A few individuals of the predaceous grasshopper, *Xiphidium fasciatum*, De G., were

found in the grass alongside infested fields; it does not appear to enter the canes, but may keep down the froghoppers in intermediate areas and so limit their spread. The mongoose, which destroys birds and lizards and so encourages insect pests, is common in Grenada.

A quantity of artificially prepared spores of the green muscardine fungus was distributed over the damaged fields in Grenada and a number of dead infected hoppers were subsequently found. In 1917, the froghoppers appeared again in both fields, but not to the same extent as in 1916. A map is given, showing the localities in which infestations of *T. saccharina* occurred.

Madan Mohan Lal (L.). **Preliminary Report on Cotton Boll Worm in the Punjab,** [*Dept. Agric. Punjab,*] *Lahore,* September 1913, 6 pp. [Received 6th June 1918.]

In the Punjab the cotton bollworm [*Earias insulana*] breeds actively from May to October, during which time it damages cotton buds, flowers and bolls. The life-cycle is completed within 30 days. In normal years this pest is naturally held in check by parasites and by the summer rains.

Two parasites of it occur, though one, a small yellow Ichneumonid, is not of great importance owing to its small numbers. The other, a Braconid, *Rhogas lefroyi*, Ashm., is abundant, and multiplies rapidly, but is highly susceptible to climatic conditions, being destroyed by the severe cold of winter.

Attempts have been made to keep this parasite under control throughout the year by the establishment of permanent breeding plots. These consist of about 2 acres of cotton which are infested with parasitised bollworm and allowed to stand from one season to the next, hollyhocks being planted to afford food and shelter to the bollworm during winter. To guard against any considerable diminution in the quantity of the host by the rapid multiplication of its parasites and the consequent destruction of both, the bollworm supply is kept as high as possible by introducing the moths into the plot. In this way host and parasite are kept in equilibrium till about the end of November, both becoming dormant during December and January. The emergence of bollworms bred upon hollyhocks takes place from February to June. Another alternative host-plant, bhindi, has been found to yield parasitised bollworms by the middle of May. Cotton buds attacked by bollworms may be found from April to June, but these are unparasitised, although *R. lefroyi* is present in bhindi pods at the time. By the end of June cotton bolls appear, 4 per cent. containing parasitised bollworms.

R. lefroyi when extensively established is found only in bolls, not a single case of parasitisation being recorded from bollworms in buds and flowers, and it cannot therefore be established by means of introducing boxes full of parasitised bolls when bolls are absent in the fields.

For the distribution of the parasite special boxes are used, the tops of which are covered with a wire mesh sufficiently small to prevent the escape of the moths, while allowing the parasites to leave them. After the parasites are established in the fields of a certain locality, the boxes should be filled with bolls in which the bollworms have already been parasitised and should then be sent out to other localities.

The distribution of parasites early in the season checks bollworm infestation from the very beginning in the bolls.

The effect of rainfall in June and July tends to prevent bollworm increase, since affected buds, flowers and early bolls being weak, are easily washed off the plants and the bollworms inside them are drowned on the ground, this process being helped by a breeze preceding or following the rain. As *R. lefroyi* can exert no influence on the bollworm in cotton during June and July, rains are the only potent factors in determining the prevalence of bollworm in cotton during this period.

During years of drought, and in districts where the rainfall is extremely scanty the early broods in cotton must be destroyed by mechanical means. This is best effected by passing a long rope to and fro over the upper third part of the plants to jerk off the affected parts, after which the fields should be thoroughly irrigated.

R. lefroyi oviposits externally on the body of the host, selecting freshly-bored bolls in which the bollworm lies close to the rind. On an average 5 to 10 eggs are laid, after which the bollworm soon dies. The eggs hatch during the first day and the whole life-cycle occupies only 9 days, the larval period lasting for 3, and the pupal for 5 days, and it is this fact that renders it such an efficient check, since it completes three generations in the time that the bollworm completes one.

MADAN MOHAN LAL (L.). **Some Important Insect Pests of Cotton in the Punjab.**—*Dept. Agric. Punjab, Lahore*, 1917, 4 pp., 3 plates. [Received 6th June 1918.]

Though attacked by a variety of insects, the cotton crop in the Punjab is seriously damaged by only three, viz.: —Cotton bollworm [*Earias insulana*], red cotton bug [*Dysdercus* sp.], and dusky cotton bug [*Dysdercus* sp.]. The life-history of the cotton bollworm and methods of controlling it have already been dealt with [see above].

The red cotton bug, which feeds upon cotton, bhindi, hollyhock and similar plants, may be found in all stages of growth upon green and open cotton bolls. Infested bolls yield light, valueless seed and poor quality lint stained by excreta. Control by mechanical means may be effected by shaking the plants over a vessel containing water and a thin layer of kerosene. The best time for this is May and June when the insects are on bhindi, and in August and September when they are on cotton bolls. Their destruction once a month is sufficient to hold them in check and prevent loss.

The dusky cotton bug lives on the same host-plants, does the same damage to cotton when present in large numbers during September and October, and may be destroyed in the same way.

BODKIN (G. E.). **The Destructive South American Locust in British Guiana. An Account of the Recent Locust Infestation.**—*Jl. Bd. Agric. Brit. Guiana, Demerara*, xi, no. 1, January 1918, pp. 3–10. [Received 11th June 1918.]

Late in June 1917 a vast swarm of locusts invaded British Guiana from Venezuela *via* Yarakita, where many descended, in the North West District. The passing of this swarm, which originated on some

of the large islands at the mouth of the Orinoco, is said to have lasted from 7 a.m. to 3 p.m. Offshoots of the main swarm that settled fed voraciously on maize and sweet cassava, which were in every instance speedily singled out and defoliated; feeding took place largely at night.

Oviposition began within a fortnight, the favourite locality being the sites of former palms, which consisted of a network of decaying roots mixed with soil, the eggs beginning to hatch from 3 to 4 weeks later.

The various measures locally adopted included :—Burning large swarms after surrounding them with plenty of dry, quick-burning bush, a method which gave good results against the younger stages; the use of traps composed of small canvas sheets or banana leaves well smeared with tar, on to which the young hoppers were brushed, this method proving highly efficacious; driving the insects into trenches in which the surface of the water had previously been coated with a film of kerosene; driving large swarms that had been previously located on to tarpaulins about 12 ft. square smeared with the thickest molasses, a method applicable only where the vegetation is sparse, but which in such localities yielded good results.

The enforcement of the Insect Pests and Plant Diseases Ordinance early in the campaign was attended with most beneficial results, and the pests were exterminated, except in two districts where the hoppers had attained maturity and consequently powers of flight.

GURNEY (W. B.). **Insect Pests of Maize.**—*N.S.W. Dept. Agric., Sydney,* Farmers' Bull., no. 116, March 1918, pp. 37–42, 3 figs. [Received 11th June 1918.]

Among the chief insect pests of maize are the grubs of Lamellicorn beetles that feed in the soil on grasses and crop roots for two years or more, hibernating in the pupal state and emerging during the following summer as adults that feed on foliage. Rotation of crops and deep ploughing in autumn are recommended as the best means of controlling them.

Similar methods are recommended against wireworms (ELATERIDAE). Laboratory experiments have shown that wireworms may be destroyed by feeding on bran poisoned with Paris green, and it is possible that limited areas might be protected by ploughing in a sprinkling of poisoned bran at the time of sowing.

Maize fields adjacent to cutworm-infested grass pastures may be to a certain extent attacked by the larvae of *Euxoa infusa* (bugong moth). Preventive measures against this Noctuid are of the utmost importance, as it is difficult to control it when once established, though large numbers may be destroyed by lightly scattering poisoned bran among the patches of seedling maize. The poison should be made of 1 oz. Paris green mixed dry with 16 oz. bran and made into a dry crumbly mash with water to which has been added half a cupful of salt to a bucket of water, or failing this, a little treacle. Certain cutworms sometimes appear in spring in vast numbers with astonishing suddenness, due to the fact that they have hibernated as partly grown larvae, the first warm days of spring causing their sudden appearance.

Pentodon australis, a black Lamellicorn beetle, has been recorded as attacking seedling maize, in which case it was present in the soil from a previous crop of infested grass.

Another beetle, a species of *Clivina*, destroys recently planted maize seeds, which should be protected by dipping them in a repellent mixture such as thin tar, and then in lime-dust with which a little Paris green has been mixed. This method, which is also used against wireworms, does not affect the germinating qualities of the seed.

Stored maize may be attacked by *Calandra oryzae* (grain weevil) and by *Sitotroga cerealella* (Angoumois moth). *C. oryzae*, the commonest Australian species, is a tropical and sub-tropical insect. *C. granaria* which flourishes in cooler regions, has been recorded only twice, in imported grain. Both these weevils are best controlled by the fumes of crude commercial carbon bisulphide, at the rate of 5 lb. or more to every 1,000 cu. ft., applied at a temperature above 70° F.

JACK (R. W.). **Notes on the Larvae, etc., of some Rhodesian Tenebrionidae.**—*S. African Jl. Nat. Hist., Pretoria*, i, no. 1, May 1918, pp. 84–98, 2 plates.

Several species of Tenebrionid beetles are of considerable economic importance in southern Rhodesia owing to the attacks on crops made by both the adult beetles and the larvae.

Adults of *Zophosis boiei*, Sol., emerge mainly at the commencement of the wet season, but do not lay eggs until March or April. The larvae feed during the winter and pupate in October and November, so that there is one generation in a year. Adults have been known to attack maize seed in dry ground, and sometimes cause serious injury to newly planted tobacco. Species of the genus *Psammodes* studied include *P. scrobicollis*, Fhs., *P. similis*, Péring., as well as larvae of *P. pierreti*, Fhs., and *P. batesi*, Haag. The larvae of *Psammodes* are active and are very cannibalistic in confinement. They feed largely on the under-ground portions of plants and constitute a serious pest of tobacco, killing the plants by eating into the underground stems. They show a particular liking for potato tubers. Adults of *P. scrobicollis* emerge at the commencement of the rains and oviposit at once. The life-cycle lasts three years, most of which is passed in the larval stage. The life-history of *P. similis* has not been worked out; growth in both these species seems to take place mainly during the wet season. These species occur chiefly on sandy soil, either sandstone or granite; the larvae have not been recorded as injurious in diorite areas. The larvae of *Distretus amplipennis*, Fhs., have similar feeding habits to those of *Psammodes*. The beetles emerge and oviposit at the beginning of the rainy season. This genus is commonest on the sand veld, but occurs also on the diorite. *Trachynotus geniculatus*, Haag., in the larval stage has similar feeding habits; two species of this genus are serious pests of tobacco. Adults of *T. geniculatus* emerge in April, at the end of the rains, and the life-cycle occupies one year, though occasional specimens may occupy two years in development. *Anomalipus plebeius*, Péring., attacks potato tubers; the life-history is not known, but adults emerge and oviposit at the beginning of the rainy season.

Of the genus *Gonocephalum*, two species have been studied, viz. :– *G. aequale*, Er., and *G. simplex*, F. With regard to the former, two distinct types of larvae have been bred from adults apparently indistinguishable from one another and are described; whether they represent distinct species is not known. The food of the larvae of *G. aequale* consists mainly of decaying vegetable matter, but they also eat into certain seeds, notably wheat. The adults do great damage to maize seed in dry land and to newly planted tobacco. They emerge chiefly at the beginning of the rains and lay eggs from March, continuing to do so in increasing numbers throughout the winter. The larvae feed during the winter and pupate just before the next rains. Adults live a considerable time, individuals having been kept for more than 12 months in confinement. This species abounds chiefly on the diorite, being relatively scarce on the sand veld. Larvae of *G. simplex* are frequently found on the surface of the soil under rubbish, and feed on decaying vegetable matter. The life-history is similar to that of *G. aequale*. This species occurs on all types of soil. Another species resembling *G. aequale* in life-history and habits is *Emyon tristis*, Fhs., which is commonly associated with it, but is found more abundantly on the sand veld than *G. aequale*.

The purpose of the variations in the life-histories of the species studied is difficult to understand. The emergence of the adult at the beginning of summer and the postponement of egg-laying until the first signs of autumn, as in the case of *Gonocephalum*, *Emyon* and *Zophosis*, is most unusual among insects. All these occur on the dioritic loam which forms a very tenacious mud in the wet season, and it may be that this environment does not suit the young larvae as well as dry conditions. *Trachynotus* spp. live over the wet season in the larval stage, but the larvae have attained considerable growth before the rains begin. The other species, which oviposit at the beginning of the rains, occur mostly on the sand veld. This paper concludes with a key to the larvae of the species discussed.

Robinson (R. H.). **The Calcium Arsenates.**—*Jl. Agric. Research, Washington, D.C.*, xiii, no. 5, 29th April 1918, pp. 281–294.

The author gives the following summary of this paper :– Pure calcium hydrogen arsenate ($Ca\ HAs\ O_4$) and tricalcium arsenate [$Ca_3\ (As\ O_4)_2$] have been prepared and methods for their preparation outlined. The specific gravity of calcium hydrogen arsenate was found to be 3·48; that of tricalcium, 3·31. The solubility of the former in 100 gm. water at 25° C. was 0·310 gm. and that of the latter was 0·013 gm. A chemical study of the relative stability showed that (a) there was no apparent reaction between either calcium hydrogen arsenate or tricalcium arsenate and lime-sulphur when combined at a dilution used in field spraying; (b) the addition of an excess of calcium oxide to either of the calcium arsenates prevented arsenic from going into solution; (c) some commercial substitutes for lime-sulphur reacted with both of the calcium arsenates; (d) the arsenates reacted with, or became soluble in organic acids and various salts, such as sodium chloride. The composition of various commercial arsenates is given and commented upon.

HAGAN (H. R.). **The Codling Moth** (*Carpocapsa pomonella*, **L.**).—*Utah Agric. Coll. Expt. Sta., Logan*, Circ. no. 30, March 1918, 4 pp., 1 fig. [Received 6th June 1918.]

This brief bulletin gives a concise account of the life-history of the codling moth (*Cydia pomonella*), together with directions for its control by spraying and banding.

HAGAN (H. R.). **The Alfalfa Weevil** (*Phytonomus posticus*, **F.**).—*Utah Agric. Coll. Expt. Sta., Logan*, Circ. no. 31, April 1918, 8 pp., 4 figs. [Received 6th June 1918.]

Hypera variabilis (*Phytonomus posticus*) (alfalfa weevil) is rapidly increasing its area of distribution, flight being the means by which this occurs. The summer flight takes place late in the season, when the adults seek shelter for hibernation, though a large percentage of them never leave the fields in which they have been feeding. In the spring, the over-wintering adults make their spring flight in search of food, these two migrations causing the weevil to spread at the average rate of 20 miles a year. Along favoured routes, such as roadways, ditchbanks and railways where escaped lucerne is growing, the rate of spread is much more rapid, and may be 50 to 60 miles in a season.

Damage is caused by the overwintering females ovipositing in the young lucerne stems, as many as 40 eggs being laid in each puncture, while a single female may lay 600 to 800 eggs during the spring. In warm, dry weather the process is completed in a few days; in a cold, wet season it extends over several weeks.

The larva, on hatching, seeks the developing leaf-buds, feeding upon the growing tip and stopping the growth. As it grows it feeds upon the larger leaves, with the result that a very light first crop is obtained, and this cannot mature till the larva has become full-grown and dropped to the ground. Here it spins a cocoon in some shelter such as a dry, curled leaf, but does not burrow into the soil to pupate. The adult emerges after a pupal period of about 10 days.

Since the greatest loss is due to larval attack on the first crop, which also delays the second crop, remedial measures should have for their aim the early maturing of the first crop. To attain this, the soil should be well opened in the spring and the best irrigation methods employed to secure maximum growth. If, as sometimes happens in cases of severe infestations, the first crop has not bloomed by the time that cutting is normally due, it is advisable to let the crop stand till about the middle of June to ensure that practically all the eggs have been laid and then to cut and remove the hay as quickly as possible. The field should then be carefully treated with the spring-tooth harrow, followed by the brush or wire drag, in order to break up the surface of the soil, to stimulate the early growth of the second crop, to tear all green tissue from the lucerne crowns so as to starve the larvae, and to make a fine dust mulch, which, heated by the hot sun, would burn and suffocate the larvae dragged into it from the crowns. For this method to be successful the field must be dry. After allowing it to remain in this condition for 2 or 3 days, it should be thoroughly irrigated, when a rapid growth of lucerne should result. As old fields are unable to resist weevil attack so well as young fields, a crop rotation limited to 4 or 5 years of lucerne is advised.

Pasturing sheep on the field for a few days in early spring has been found beneficial, and on gravelly land where the dust mulch is an impossibility, spraying the young crop with lead arsenate at the rate of 5 lb. paste to 100 U.S. gals. water undoubtedly kills many of the larvae. This method cannot however be recommended on account of its cost and the possible danger of poisoning stock.

JONES (C. R.). **Grasshopper Control.**—*Colorado Agric. Expt. Sta., Fort Collins*, Bull. no. 233, June 1917, 27 pp., 8 figs. [Received 6th June 1918.]

This bulletin gives an account of the life-history of the various species of destructive grasshoppers found in Colorado and describes the usual methods of control with particulars of the apparatus used.

The more important species are *Melanoplus atlantis*, Riley, *M. bivittatus*, Say, *M. differentialis*, Thom., and *M. femur-rubrum*, De G. Natural enemies include several parasitic and predaceous insects; a species of *Sarcophaga* has been bred abundantly from both nymphs and adults. The large Carabid beetle, *Calosoma obsoletum*, Say, and a robber fly, *Promachus* sp., have been observed on various occasions feeding upon young grasshoppers. Solitary wasps, such as *Priononyx atratus*, are also instrumental in destroying young hoppers. A list is given of insectivorous birds that constantly feed upon grasshoppers and other insects, while all domestic birds are known to aid materially in checking them, but are only of practical value on small areas.

PETTIT (R. H.). **Report of the Entomologist.**—*56th Ann. Rept. (1st July 1916 to 30th June 1917) Michigan State Bd. Agric., Lansing*, 1917, pp. 321–322. [Received 5th July 1918.]

During the period under review the pests that were more troublesome than usual included Aphids, particularly on fruits, onion maggot [*Hylemyia antiqua*], cabbage maggot [*Phorbia brassicae*] and bean maggot [*P. fusciceps*]. The clover leaf beetle [*Hypera punctata*] was present in some districts early in the season and another weevil, *Sitones hispidulus*, became so numerous on lucerne that in some localities entire fields were destroyed. The fruit-tree leaf-roller [*Cacoecia argyrospila*] continued to thrive in restricted areas and proved very difficult to control. The tomato stalk-borer, *Papaipema nebris* (*nitela*), ravaged potato fields, while a similar, if not the same borer destroyed many young maize plants. Experiments in the control of woolly aphis [*Eriosoma lanigerum*] on young apple trees in nurseries are being carried on.

NOTEWARE (J. R.). **Report of the South Haven Experiment Station.**—*56th Ann. Rept. (1st July 1916 to 30th June 1917) Michigan State Bd. Agric., Lansing*, 1917, pp. 673–678.

Various sprays for scale-insects were used during the period, but owing to lack of uniform conditions of application it was impossible to determine the relative merits of the materials employed. For Aphids on apples, "nicotine sulphate 40 per cent., 1 oz. to 8¼ U.S. gals., combined with lime-sulphur," was used, and also Scalecide, 1 gal.

to 30 gals. Nicotine gave the better results and no injury to foliage resulted from its use. For larvae of codling moth [*Cydia pomonella*] on apples, dry arsenate of lead and arsenite of calcium were tried to determine their comparative values. Three applications of each substance combined with summer strength of lime-sulphur were given; lead arsenate proved to be the better poison. Pear psylla [*Psylla pyri*] caused considerable trouble in some localities, and as spraying was not begun promptly, many orchards were badly infested by mid-summer. Three mixtures were used as sprays: kerosene emulsion, 40 per cent.; nicotine 1:800 and soap; and a mixture consisting of 40 lb. stone lime, 1 U.S. pint nicotine and 1 U.S. gal. lime-sulphur to 100 U.S. gallons. These mixtures were applied in early August; very little difference in effectiveness was observed, control in each case being far from complete. The wash containing lime seemed to be the best deterrent, but should have been applied earlier.

NOWELL (W.). **Infection of Orange Fruit through Bug Punctures.**—*Agric. News, Barbados*, xvii, no. 418, 4th May 1918, p. 142.

The sweet orange has to be added to the list of fruits serving as hosts for the fungi associated with the internal boll disease of cotton bolls. An orange purchased in Barbados and reputed to have come from Grenada was infested in many spots with a prolific culture of *Nematospora* sp.; there is little doubt that the infection had been introduced by the punctures of some plant-feeding bug.

Report on the Prevalence of Some Pests and Diseases in the West Indies during 1916. (Compiled from the Reports of the Principal Agricultural Officers.)—*West Indian Bull., Barbados*, xvi, no. 4, 1918, pp. 309–331.

This is a résumé of various local reports, much of the information from which has already been noticed [see this *Review*, Ser. A, iv, p. 416, v, pp. 330 and 392–394].

WILMOT (N. E.). **English Sparrow (*Passer domesticus*) feeding on the Larva of the Elm-tree Beetle.**—*U.S. Dept. Agric. Expt. Sta. Record, Washington, D.C.*, xxxviii, no. 5, April 1918, p. 457. (Abstract from *Auk*, xxxiv, no. 4, 1917, pp. 479–480.)

The English sparrow is recorded as feeding on the elm-tree beetle [*Galerucella lineola*] in large numbers, and also upon small moths on the wing, May beetles [*Lachnosterna*], etc. The author is of opinion that the sparrow is becoming more insectivorous every year.

BREDEMANN (G.). **Die Heuschreckenplage in Kleinasien und ihre Bekämpfung im Jahre 1916.** [The Locust Plague in Asia Minor and combative Measures in 1916.]—*Zeitschr. f. Pflanzenkrankheiten, Stuttgart*, xxvii, no. 7–8, 31st January 1918, pp. 364–365. (Abstract from *Die Umschau*, 1917, pp. 29–34, 11 figs.)

The author was inspector of the measures taken by the Turkish authorities against *Dociostaurus* (*Stauronotus*) *maroccanus*, which had

already spread over the whole of West Anatolia. The eggs are deposited in batches of about 35 during a period of 6 weeks ending in mid-August. About 8 or 9 months later, from mid-March to mid-April, the hoppers hatch out. The measures against the eggs and hoppers were organised on military lines. About 87,000 acres were ploughed up and about 6,420 metric tons of eggs were destroyed. The hoppers were driven together and either trampled or beaten to death. As this involved a disproportionate number of workers—from 450,000 to 500,000 people being employed in 11 districts—a new method was introduced in which strips of zinc about 1 foot high were placed across the path of the invasion with trap-trenches on the side nearest the locusts. By means of such a strip, about ½ a mile long, 35–40 men were able to catch about 100 metric tons of hoppers in 2 days; with the old system at least 1,000 workers would have been required.

SCHUMACHER (F.). *Pseudococcus vovae*, **Nassonow, eine für Deutschland neue Schildlaus.** [*Pseudococcus vovae*, Nassonov, a Scale-insect new to Germany.]—*Zeitschr. f. Pflanzenkrankheiten, Stuttgart*, xxvii, no. 7–8, 31st January 1918, p. 366. (Abstract from *Sitzungsber. d. Gesell. naturf. Freunde zu Berlin*, 1916, pp. 346–347.]

In 1916 the author found *Pseudococcus vovae*, Nass., in great abundance in Brandenburg on *Juniperus communis*, the same plant on which it was discovered by Nassonov in Poland in 1906. This constitutes the first record of this scale in Germany.

SCHUMACHER (F.). **Auftreten einer Tamariskenzikade in Brandenburg.** [The Appearance of a Tamarisk Cicada in Brandenburg.] *Zeitschr. f. Pflanzenkrankheiten, Stuttgart*, xxvii, no. 7–8, 31st January 1918, p. 368. (Abstract from *Sitzungsber. d. Gesell. naturf. Freunde zu Berlin*, 1916, pp. 241–241.)

In October 1916 tamarisk plants near Berlin were found to be infested by the cicada, *Opsius heydeni*, Fischer, which apparently is more widely distributed through Germany than has hitherto been believed.

SCHUMACHER (F.). **Ueber die Gattung** *Stethoconus*, **Flor (Hem. Het. Caps.).** [The Genus *Stethoconus*, Flor (Hem. Het. Caps.).]—*Zeitschr. f. Pflanzenkrankheiten. Stuttgart*, xxvii, no. 7–8, 31st January 1918, p. 368. (Abstract from *Sitzungsber. d. Gesell. naturf. Freunde zu Berlin*, 1916, pp. 344–346.)

In 1910 Nawa recorded in Japan (*Insect World*, xiv, p. 8) a Capsid enemy of *Stephanitis* (*Tingis*) *pyrioides*, which is allied to the European pear Tingid, *S.* (*T.*) *pyri*. The larvae of the two species are very similar. The author considers this Capsid to be *Stethoconus japonicus*. *S. mamillosus*, Flor (*cyrtopeltis*, Flor) is an enemy of *Stephanitis pyri* in Europe, its larvae sucking those of the latter. Besides the apple and pear, *S. pyri* injures the apricot, peach, *Prunus lusitanica* (Portugal laurel) and *Juglans regia* (walnut); in Livonia it is attacked by *Stethoconus oberti*, Kol. As an indirect means of checking the pear Tingid is of high practical value, a further study of the habits of these Capsids is advisable.

FULMEK (L.). **Die Birngallmücke.** [The Pear Gall Fly.]—*Zeitschr. f. Pflanzenkrankheiten, Stuttgart,* xxvii, no. 7–8, 31st January 1918, p. 370. (Abstract from *Mitt. der K.K. Pflanzenschutzstation in Wien,* 1916.)

Descriptions are given of *Contarinia pyrivora,* Ril., and of the injury caused by it to young pears. The collection of damaged fruit and the cultivation in autumn of the ground beneath the tree or covering it with caustic lime or kainit, or watering it with carbolineum, are the measures advocated.

TASCHENBERG (O.). **Einige Bemerkungen über die Lebensweise eines Chalcidiers (*Syntomaspis pubescens,* Mayr).** [Some Observations on the Life-history of *Syntomaspis pubescens,* Mayr.]—*Zeitschr. f. Pflanzenkrankheiten, Stuttgart,* xxvii, no. 7–8, 31st January 1918, p. 378. (Abstract from *Zeitschr. f. wiss. Insektenbiolog.,* xii, 1916, pp. 319–320.)

The apple must be added to the plants attacked by the Chalcid, *Syntomaspis pubescens,* Mayr, it having been found in apples of the 1915 crop in Swabia.

RUSCHKA (F.). **Zur Lebensweise des Apfelchalcidiers.** [The Life-history of the Apple Chalcid.]—*Zeitschr. f. Pflanzenkrankheiten, Stuttgart,* xxvii, no. 7–8, 31st January 1918, p. 378. (Abstract from *Zeitschr. f. wiss. Insektenbiolog.,* xiii, 1917, p. 33.)

In addition to being present in Hungary and Russia, *Syntomaspis druparum,* Boh., is also found in the larval stage in small apples in Styria and northern Austria, where there is one annual generation. The identity of this pest with *S. pubescens* has not yet been established.

WIERENGA (O. M.). **Waarschuving tegen de Anggrang (roode Mier).** [A Warning against the Red Ant, *Oecophylla smaragdina,* F.]—*Zeitschr. f. Pflanzenkrankheiten, Stuttgart,* xxvii, no. 7–8, 31st January 1918, p. 378. (Abstract from *Meded. Proefstation Malang, Soerabaya,* no. 13, pp. 15–16.)

The red ant, *Oecophylla smaragdina,* F., is of universal occurrence in Java and when present in large numbers in coffee and *Hevea* plantations its bite is so troublesome to the workers that its extermination becomes necessary. The destruction of the nests by plunging them in hot water is the only reliable remedy.

SCHWARTZ (M.). **Schutz der Oelfrüchte gegen Schädlinge.** [The Protection of Oil-yielding Plants against Pests.]—*Deutsche Landwirtschftl. Presse, Berlin,* xlv, no. 34, 27th April 1918, pp. 210–211, 12 figs.

The increased cultivation of oil-producing plants in Germany favours their insect enemies and the most important of these are therefore briefly described in this article.

The larva of the beetle, *Psylliodes chrysocephala,* L., winters in rape and beet crops, feeding on the pith of the stems. From May onwards the adults feed on the leaves and shoots and in autumn they sometimes destroy entire fields of winter rape and beet. Oviposition

takes place in the leaf-axis of rape, cabbage and *Mathiola incana*. The beetles drop when the plants are gently shaken and are easily captured by means of tarred boards. Another larva injurious to the stems is that of the weevil, ***Baris chlorizans***, Germ., the hibernating adults of which deposit their eggs in spring in the stems of young rape and beet, near the leaf-axis. All stumps of rape, beet and cabbages should be pulled up and burnt immediately after harvesting. The flowers of cruciferous plants are attacked in May by *Meligethes aeneus*, F. This beetle may be captured like *P. chrysocephala*; in pre-war times dusting with a mixture of 1 part insect powder and 2 parts flowers of sulphur was resorted to. *Ceuthorrhynchus assimilis*, Payk., also gnaws the flowers and buds. Its larva feeds on the pistils of the flowers and on the unripe seed of the young pods, which then open prematurely. The injury resembles that of *Perrisia* (*Dasyneura*) *brassicae*, Wied. (cabbage gall-midge), but the larvae of *P. brassicae* are found in numbers (up to 50–60) in a pod, whereas that of *C. assimilis* occurs singly. No remedies are known against either of these pests, which, however, do less damage than the caterpillars of *Evergestis extimalis*, Scop., which feed on the seeds and pods of rape, radish, cabbage and mustard. Deep ploughing after the harvest destroys the overwintering caterpillars. The caterpillars of *Phalonia* (*Conchylis*) *epilinana*, Zell., attack flax-seeds in their capsules. Infested flax must be threshed out soon after the harvest. In some years the foliage of rape, mustard and flax is seriously injured by the larva of the sawfly, *Athalia colibri* (*spinarum*), which also lives on all varieties of cabbage and on many weeds. Collection of the larvae or their destruction by cultural methods when hibernating in the soil are the measures advised. *Euxoa* (*Agrotis*) *segetum* proved especially harmful in Germany in 1917. *Ceuthorrhynchus sulcicollis*, Gyll., oviposits in May in the roots of rape and the larva is enveloped in a gall which reaches the size of a hazel-nut. After about a month the larva bores its way out and pupates in the ground; the beetles emerge about a month later. All stumps should be pulled up and burnt immediately after the harvest and ploughing, rolling and harrowing are also useful measures.

MAZIÈRES (A. de). **Nouveau Procédé de Destruction de la Mouche de l'Olive.** [A New Method of Destruction of the Olive-fly.]—*Rev. Hortic. de l'Algérie, Algiers*, xxii, nos. 4–5, April-May 1918, pp. 62–63.

This paper describes the device invented by Lotrionte for trapping the adults of *Dacus oleae* [see this *Review*, Ser. A, ii, p. 289], and gives recommendations for preparing and applying the poison [see this *Review*, Ser. A, ii, p. 452].

YANO (M.). **Nekirimushi no tekichu ni tsuite.** [On the Insect Enemies of Root-cutting White Grubs.]—*Ringyo Shiken Hokoku.* [Report of Forest Experiments], *Imperial Bureau of Forestry, Tokyo*, no. 17, 30th March 1918, pp. 59–66, 1 plate.

White grubs, or the larvae of Lamellicorn beetles, are known to do formidable damage to the roots of young forest trees, sugar-cane and many farm crops. There are no known effective measures against

these pests; the use of carbon bisulphide or naphthaline and the collection of the adult beetles are the only ones yet recommended.

Recently the attention of economic entomologists has been directed towards a search for their enemies, both parasitic and predaceous, such as those of *Anomala orientalis* in Hawaii. The insect enemies of these beetle larvae include a number of SCOLIIDAE. Thus in North America *Elis quinquecincta* and *Tiphia inornata* are parasitic on *Lachnosterna*; in Europe, *Tiphia femorata* on *Amphimallus (Rhizotrogus) solstitialis*, *Scolia bifasciata* on *Cetonia*, and *S. interrupta* on *Anoxia villosa*; in Java, *Elis thoracica* and *E. luctuosa* on *Anomala*; and finally, the species that is parasitic on the Japanese *Anomala orientalis*, which was discovered by Muir of the Hawaiian Sugar Experiment Station and is said to belong to the same genus, *Elis*. Though many beetles are known to prey upon other insects, none have hitherto been discovered that attack subterranean white grubs. Recently a beetle was sent to the author which was said to be predaceous upon them. It proves to be a species of *Hister* and, as this beetle generally lives under decayed leaves or rotten bark, though it may eat the grub under observation in confinement, whether it really preys on them underground requires further confirmation.

As regards Dipterous parasites, according to Davis, in North America *Microphthalma disjuncta*, *M. pruinosa* and *Ptilodexia tibialis* are said to infest *Lachnosterna* grubs; the author has not yet, however, found any such species in Japan. In May 1914 the author received an Asilid larva from the Nagasaki Prefecture, and reared from it an adult that proved to be *Promachus yesonicus*, Big. (*P. ater*, Coq.). In 1916 further Asilid larvae were received from the Prefecture of Nagano that were stated to be numerous among the beetle grubs in seed-beds for forest trees. These, as well as the one found by the author himself in a seed-bed of the Tokyo Forestry Experiment Station, produced adults of the same species in July and August of the following year. Several lots of specimens of this species were subsequently obtained from forestry seed-beds in the Prefecture of Kagoshima. From the study of these examples, the author is of opinion that this Asilid larva is an important enemy of Lamellicorn grubs in Japan. Recently Davis has also recorded the fact that *Promachus vertebratus* and *P. fitchi* prey upon the larvae of *Lachnosterna* in the United States [see this *Review*, Ser. A, iv, p. 285].

The adult fly of *Promachus yesonicus* appears in the month of June and is predaceous on a great variety of insects, including the adults of white grubs. It oviposits in August, on grasses, weeds or even on telegraph poles; the eggs are white and are laid in masses. As soon as the young larvae hatch they immediately bury themselves in the soil and begin to feed on the beetle grubs. It was not possible to ascertain how many grubs the fly larva destroys during its life-time, but just before pupation two medium-sized grubs were required to keep it alive for a week. The author was unable to rear the adult from the egg, so that the exact duration of the life-cycle could not be ascertained; but in all probability pupation occurs in the early summer of the second year, and the adult flies appear from June to the beginning of August. Further investigation is still required as to the practical utilisation of these Asilid larvae. As they are usually found mixed up with the injurious grubs, when measures

are undertaken to exterminate these pests, the former should be carefully protected. And as the eggs are so conspicuous and easily found owing to their white colour, they should be collected and introduced into places where grubs are numerous.

DVORNITCHENKO (M.). **Нѣкоторыя наблюденія надъ люцерной.** [Some Observations on Lucerne]. **Изъ работъ Андижанской Опытной Станціи.** [From the Work of the Andizhan (Fergana) Experimental Station.]—**«Туркестанское Сельское Хозяйство.»** [*Agriculture of Turkestan*], *Tashkent*, xii, no. 1, January 1917, pp. 22-35. [Received 12th July 1918.]

In 1914 *Hypera* (*Phytonomus*) *variabilis* appeared in large numbers on the lucerne field of the Station and greatly injured the foliage. It was found that although mowing may be regarded as exercising some degree of control, it must be done while the larvae are still young; otherwise they may complete their development and pupate on the ground. The larvae are very active and prefer warm spots, such as are exposed to the sun; plants under trees were very little damaged, if at all. The first larvae in 1915 were noticed in the middle of March; later they appeared to suffer from a fungus disease, from which about 65 per cent. perished; another 9 per cent. were killed by an Ichneumonid parasite, *Canidia curculionis.* In this connection attention is called to the fact that the mowing of lucerne may prove harmful to parasites, while insecticides may check the spread of beneficial fungi.

VASSILIEV (I. I.). **Гусеница, производящая «чеканку» хлопчатника.** [Caterpillars producing the Dwarfing of Cotton.]—**«Туркестанское Сельское Хозяйство.»** [*Agriculture of Turkestan*], *Tashkent*, xii, no. 1, January 1917, pp. 94–97, 1 fig. [Received 12th July 1918.]

The caterpillars of a number of moths give rise to the dwarfing of cotton by injuring the apical buds, thus preventing further upward growth and causing the plant to spread horizontally. In Transcaucasia and Turkestan this effect is most commonly produced by the caterpillars of *Platyedra vilella*, which in their early stages remain on the cotton foliage, passing later to the apical buds, of which each destroys several, and then penetrating into the stem where they bore a short mine. The caterpillars travel from one plant to another and when mature pupate in the stem. Their presence is indicated by the brown excreta round the entrance hole. This pest breeds also on the fruits and stems of various malvaceous plants, particularly of *Althea nudiflora*, which latter, in the opinion of the author, forms its chief breeding place, and from there it invades cotton. Another insect damaging cotton in a similar manner is the caterpillar of *Cacoecia strigana*, which attacks the apical buds and young leaves, but seldom enters the stem. The presence of this pest can be detected by the withered leaves, entangled with web at the ends of the shoots, which remain for a long time on the plant. This moth also breeds on a number of weeds. In rare cases cotton is also injured by *Eucosma luctuosana* (*Epiblema cirsiana*), which however does not injure the

apical bud, but mines the stem and frequently also the branches; its usual host-plants are various species of *Cirsium* and *Carduus*. Cotton is occasionally injured by the caterpillars of *Pyrausta nubilalis* (*Botys silacealis*), which bore a long mine in the upper part of the stem, causing it to break and hang down.

Gratchev (A.). **О новомъ способѣ уничтоженія саранчи. (Микробіологическій методъ борьбы съ саранчей).** [A new Method of destroying Locusts. (The Bacteriological Method).]—**« Туркестанское Сельское Хозяйство.»**—[*Agriculture of Turkestan*], *Tashkent*, xii, no. 2, February 1917, pp. 110–116. [Received 12th July 1918.]

This is a plea for giving *Coccobacillus acridiorum*, d'Hérelle, a fair trial in Russia and for a careful study of its possibilities of checking the ravages of *Dociostaurus* (*Stauronotus*) *maroccanus* and *Locusta* (*Pachytylus*) *migratoria* in Turkestan.

Uvarov (B. P.). **Отношеніе энтомологовъ къ новому методу борьбы съ саранчевыми.** [The Attitude of Entomologists to the new Method of controlling Locusts.]— **« Туркестанское Сельское Хозяйство.»** [*Agriculture of Turkestan*], *Tashkent*, xii, no. 6, June 1917, pp. 343–348. [Received 12th July 1918.]

In this reply to the above article, the author expresses the opinion that the bacteriological method of controlling locusts has not yet been fully studied and that further careful scientific investigations are extremely necessary. For the time being the popularisation of this method is therefore inopportune, as tending to discredit the established remedial methods now in use.

Противосаранчевыя работы въ 1917 году. [Anti-Locust Operations in 1917.]—**« Туркестанское Сельское Хозяйство.»** [*Agriculture of Turkestan*], *Tashkent*, xii, no. 2, February 1917, pp. 139–144. [Received 12th July 1918.]

Owing to a large outbreak of locusts in 1916, favoured by the weather conditions and by the absence of a proper campaign against the larvae, due to a variety of causes connected with the War, over 225,000 acres of land in the provinces of Samarkand and Syr-Darya were infested with egg-clusters. Such an extensive oviposition by locusts has not occurred since 1912, and the sum of £150,000 was assigned for the campaign in 1917. Of this over £50,000 was estimated to cover the cost of labour and over £25,000 that of insecticides. It was proposed to use Locusticide, Paris green, white arsenic and sodium arsenite for spraying and to spend about £16,000 on poisoned baits.

Къ вопросу о постоянныхъ организаціяхъ по борьбѣ съ вредителями и болѣзнями сельско-хозяйственныхъ растеній въ Туркестанскомъ краѣ. [On the Question of the permanent Organisations for the Control of Insect Pests and Diseases of cultivated Plants in Turkestan.]—**« Туркестанское Сельское Хозяйство.»** [*Agriculture of Turkestan*], *Tashkent*, xii, no. 2, February 1917, pp. 144–148. [Received 12th July 1918.]

The full text of the regulations governing the organisation of local

bureaus for the control of pests in Turkestan, as agreed at the Provincial Interdepartmental Conference at Tashkent [see this *Review*, Ser. A, v, p. 304] is given, and also the estimated budgets of the bureaus, the maintenance expenses of each of which is placed at about £2,200. Three local bureaus are projected, one for each of the provinces of Syr-Darya, Samarkand and Fergana. The total cost of the whole organisation amounts to from £7,500 to £8,000.

T. S. **О саранчевыхъ работахъ въ Бухарѣ.** [On Anti-locust Measures in Bokhara.]—**«Туркестанское Сельское Хозяйство.»**—*Agriculture of Turkestan*], *Tashkent*, xii, no. 4-5, April-May 1917, p. 310. [Received 12th July 1918.]

This is a note recording the completion of the anti-locust operations in Bokhara in 1917. Owing to the exceptional drought and the absence of grass, the pests either did not hatch at all, or perished in the early stages; consequently in many localities no operations against them were necessary.

Smirnov (D.). **Опытъ опыленія хлопка сѣрнымъ цвѣтомъ противъ паутиннаго клеща, его результаты, анализъ роста и плодоношенія хлопка лѣтомъ 1914 г. въ Мургабскомъ (бывшемъ Государевомъ) Имѣніи.** [An Experiment on dusting Cotton with Flowers of Sulphur against *Tetranychus*, *telarius*, L., its Results, Analysis of the Growth and Harvest of Cotton in the Summer 1914 on the Murgab (late Imperial) Estate.]—**«Туркестанское Сельское Хозяйство.»** [*Agriculture of Turkestan*], *Tashkent*, xii, nos. 4-5, 7-8, April-May, July-August 1917, pp. 214-226, 423-428, 10 figs. [Received 12th July 1918.]

These are the first two instalments only of this article on the effect of sulphur on *Tetranychus telarius* and the conclusions arrived at are incomplete.

Former experiments by the author and K. E. Demokidov, undertaken in 1912-13, established the fact that dusting with sulphur is an effective remedy against *Tetranychus telarius*, being especially destructive to the eggs, which turn red and shrivel within a few days after the treatment. Laboratory experiments show that eggs of this mite are affected in the same way by the action of sulphur dioxide gas.

Although the results of these experiments seemed conclusive, it was found necessary to repeat them under various conditions of cotton cultivation and at different seasons. The chief damage done by the mites consists in the dropping of buds and flowers, while the defoliation of the plants is harmful only in June and July, and this occurs only exceptionally. Further, various enemies greatly reduce the numbers of the mites towards the end of July, and it would therefore appear that the end of June is the most suitable time for applying the sulphur. These natural enemies include larvae and adults of *Scymnus* and *Coccinella*, larvae of *Chrysopa*, a Cecidomyid, the larvae and adults of Anthocorid bugs, and a small spider.

In 1912-13 it was found that the mites winter on the under-side of the leaves, and consequently an outbreak in one year is followed by infestation of the plants next year, if sown on the same field. Before the appearance of the cotton seedlings the increase of the mites depends

on the number and kinds of weeds surrounding the plantation; thus the wet spring of 1913, owing to a large growth of weeds, led to a severe outbreak; while in 1914, the spring droughts and the scarcity of weeds resulted in a very belated and limited appearance of the pest. The destruction of weeds by ploughing early in spring is accordingly an effective remedy.

The experiments of 1914 were conducted on two plots, one of which was watered thrice, and the other twice. A detailed description of the plots and the weeds overgrowing them is given. Amongst the latter, special mention is made of *Saussurea amara*, L., on the leaves of which the mites breed only in spring until May. In so far as the growth of the plants is concerned, both the dusted and undusted plants of the plot subjected to three waterings were practically of the same height, while of the plants with two waterings the undusted ones were higher than the dusted. Evidently the sulphur affects the growth, and the additional watering gives the plants sufficient strength to withstand this effect. The number of leaves is also reduced by dusting, though at the same time it saves some of them from dropping and by destroying the mites allows the plant to produce more foliage. As to the pest itself, the results tend to show that the absence of sufficient moisture favours its development; and that dusting with sulphur destroys the mites and decreases the injury to cotton.

The conclusions as to the effect of the combined dusting and watering on the buds and flowers cannot be summarised, as they are not complete.

VAN HALL (C. J. J.). **Ziekten en Plagen der Cultuurgewassen in Nederlandsch-Indië in 1917.** [Diseases and Pests of cultivated Plants in the Dutch East Indies in 1917.]—*Meded. Laboratorium voor Plantenziekten, Buitenzorg*, no. 33, January 1918, 42 pp.

Owing to the wet east monsoon [dry season] of 1916 and the prolonged rains during the west monsoon of 1917 insect injury was less severe than in previous years. *Helopeltis*, however, was an exception and did much damage to tea. The locust infestation of teak, *Hevea* and coconut was negligible, whereas it has been noticeable everywhere in 1915. The inadequate shipping facilities and consequent accumulation of produce resulted in greatly increased loss through insects, but the experience of 1916 having led to universal fumigation with carbon bisulphide, tobacco of the 1917 crop suffered little from *Lasioderma* [*serricorne*] and *Setomorpha* [*margalaestriata*]. Potatoes were seriously attacked in some districts by a Coccinellid, *Epilachna* sp. *Arachis hypogaea* planted at the beginning of the east monsoon [about mid-April] was injured by a Typhlocybid leaf-hopper, about 25 per cent. of the crop being lost.

Cacao suffered less from *Helopeltis*, and a reduction of infestation was observed in estates where measures were taken against the gramang ant [*Plagiolepis longipes*], and the black cacao ant [*Dolichoderus bituberculatus*] was introduced. Borers were unimportant; *Zeuzera* was less abundant and *Phassus damor* was reported once only. In the dry season a Diaspine scale occurred abundantly in some localities and was followed by a fungus infestation. Teak forests were infested as usual by *Calotermes tectonae*, *Duomitus ceramicus*, Wlk., and

Hyblaea puera, Cram. It is certain that the yearly destruction of the young leaves by the latter moth must be detrimental to the production of timber, nor can the injury done by *C. tectonae* be unimportant. Infestation by the locust, *Cyrtacanthacris nigricornis*, was not observed, the outbreak having ended with the wet weather in 1915 and 1916. In gambir [*Uncaria*] plantations on the Sumatran east coast, the Capsid, *Helopeltis sumatranus*, Roepke, was noticed, and experiments showed that this insect attacks tea in preference to gambir [see this *Review*, Ser. A, vi, p. 38]. *Hevea* was practically free from insect attack; one case of infestation with *Coptotermes gestroi* was reported, while *Oecophylla* [*smaragdina*] was often troublesome to workers in rubber plantations. Kapok [*Eriodendron anfractuosum*] in nurseries was infested by the scale, *Pseudococcus* (*Dactylopius*) *adonidum*. *Glycine soya* was injured by *Agromyza*. Cinchona was attacked by *Helopeltis antonii* and by the mites, *Tetranychus telarius* (*bimaculatus*) (cassava mite), *Tarsonemus translucens* and *Brevipalpus obovatus*; *T. telarius* was the most injurious of these.

Coconut pests included a Hispid, the Dynastid, *Oryctes* [*rhinoceros*], the Curculionid, *Rhynchophorus* [*ferrugineus*], the Pyralid, *Melissoblaptes* [*rufovenalis*], and *Brachartona catoxantha*. The last-named moth occurred in a great many districts; a fairly successful remedy was the removal and burning of infested leaves.

Coffee pests included *Plagiolepis longipes*; *Coccus* (*Lecanium*) *viridis*; *Oecophylla* [*smaragdina*]; the Nematode, *Tylenchus coffeae*; *Pseudococcus* sp.; and the coffee beetle, *Araecerus* sp. Nipa palms on the east coast of Sumatra were attacked by *B. catoxantha*. Rice was infested by a Cecidomyid midge; leaf-eating caterpillars; the larvae of beetles, apparently *Holotrichia helleri* and *Anomala atrovirens*; the bug, *Leptocorisa acuta*; and Hesperid caterpillars. Tobacco was infested by *Thrips*, *Prodenia*, *Agrotis* and *Heliothis*. Tea pests included *Helopeltis*, *Eriophyes* (*Phytoptus*) *carinatus* (purple mite), *Tarsonemus translucens* (yellow mite), *Tetranychus telarius* and *Brevipalpus obovatus*. *Tephrosia candida*, which is becoming popular as a green manure crop, suffered severely from the Tephrosia beetle (*Araecerus fasciculatus*).

The following are some of the timber pests observed:—*Zeuzera coffeae* in *Toona sinensis* and *Swietenia mahagoni*, the latter tree being attacked also by a borer of the genus *Heterobostrichus* or closely allied to it. The seeds of various Leguminosae were infested by seed-borers. Those of *Acacia leucophloea*, *A. tomentosa*, *Albizzia procera* and *A. lebbekoides* were attacked by a small beetle, thought to be a Bruchid, while a larger species, apparently *Pachymerus* (*Caryoborus*) *gonagra*, F., was found in the seeds of *Bauhinia malabarica* and *Acacia tomentosa*. Timber was also attacked by a Hepialid root-borer apparently identical with *Phassus damor*, Moore.

Illingworth (J. F.). **The Leather Beetle (*Dermestes vulpinus*, F.), a Troublesome Pest of Dried Fish in Hawaii.**—*Proc. Hawaiian Entom. Soc. for the Year 1917, Honolulu*, iii, no. 5, April 1918, pp. 375–378.

Dermestes vulpinus, F., which is well-known as a leather pest in the United States, and has caused much damage in warehouses for hides

in London, is very destructive to dried fish in Honolulu. Newly emerged beetles were confined in glass jars and their life-history studied. After a pre-oviposition period of some ten days, eggs are laid in any available crevice and hatch in about three days. The larvae moult six times and then leave their food in order to pupate, sometimes boring into cork or wood to find a hiding place. The complete life-cycle requires 64 days. Adults were kept for 3 months in the glass jars without water or air, but abundantly supplied with dried fish. Apparently they can subsist and reproduce generation after generation in this way.

SWEZEY (O. H.). **New Records of Insects on Kauai.**—*Proc. Hawaiian Entom. Soc. for the Year 1917, Honolulu,* iii, no. 5, April 1918, pp. 379–380.

The Ichneumonid, *Cremastus hymeniae*, was found abundantly parasitising *Nacoleia* (*Omiodes*) *blackburni* (coconut leaf-roller). One example was bred from *Cryptophlebia illepida* in a pod of *Acacia farnesiana*. *Pseudogonatopus hospes*, a Chinese Dryinid parasitic on the sugar-cane leaf-hopper [*Perkinsiella saccharicida*], occurred in cane-fields. A hyper-parasite on Dryinids, *Helegonatopus pseudophanes*, also occurred. The Tachinid imported from New Guinea, *Ceromasia sphenophori*, was found parasitising both larvae and pupae of *Rhabdocnemis obscurus* (sugar-cane borer) in the bases of petioles of coconuts. This is the first record in the Islands of this fly attacking the borer larvae in any other plant than sugar-cane. The Pompilid wasp, *Psammochares luctuosus*, was observed in cane-fields. *Sarcophaga haemorrhoidalis* was attracted abundantly in some localities to the juice on the cane in cane-cars at the mills. The grasshopper, *Atractomorpha crenaticeps*, is recorded for the first time on any of the Hawaiian Islands except Oahu. The same may be said of *Gryllotalpa africana* (mole-cricket).

TIMBERLAKE (P. H.). **Notes on Some of the Immigrant Parasitic Hymenoptera of the Hawaiian Islands.**—*Proc. Hawaiian Entom. Soc. for the Year 1917, Honolulu,* iii, no. 5, April 1918, pp. 399–404.

A comparison of the introduced or immigrant Hawaiian parasitic Hymenoptera with United States types has resulted in a certain revision of the identification of several species. The Ichneumonid, *Hemiteles tenellus*, Say (*variegatus*, Ashm., *melitaeae*, Ashm.) is the name adopted for the Hawaiian parasite belonging to this genus; it is frequently reared in the Islands from cocoons of *Chrysopa microphya*. *Angitia polynesialis*, Cam. (*A. plutellae*, Vier., *A. hellulae*, Vier.) is usually bred from *Plutella maculipennis*, Curtis, in Hawaii as in the United States. It is not unlikely that this species occurs in Europe and an earlier name may possibly be found for it. The Braconid, *Diaeretus chenopodiaphidis*, Ashm., and not *D. rapae*, Curtis, is reared in Hawaii from *Aphis brassicae*, L., and *Myzus* (*Rhopalosiphum*) *persicae*, Sulz. A small species of *Opius* that has recently been bred from *Agromyza* on *Lantana* is considered to be most probably a new species close to *O. nanus*, Prov. The Pteromalid, *Pachyneuron siphonophorae*, Ashm., of which *P. micans*, How., is considered a

synonym, is a hyper-parasite of Aphids and in Hawaii attacks *Ephedrus incompletus* and *Diaeretus chenopodiaphidis*. *Encyrtus infelix*, Embleton, which was wrongly determined by Ashmead as *Encyrtus fuscus*, How., is parasitic on *Saissetia hemisphaerica*, Targ. *Dinocampus terminatus*, Nees, of which *Perilitus americanus*, Riley, and *Euphorus sculptus*, Cress., are synonyms, was probably introduced from North America with *Olla abdominalis*, Say, but now usually attacks another Coccinellid, *Coelophora inaequalis*, F. The Aphelinid, *Prococcophagus orientalis*, How., which has been variously recorded in local literature as *Coccophagus orientalis*, *Aneristus* sp. and *A. ceroplastae*, is one of the most efficient Coccid parasites in Hawaii, with a wide range of hosts.

CRAWFORD (D. L.). **The Jumping Plant Lice (Family Psyllidae) of the Hawaiian Islands.**—*Proc. Hawaiian Entom. Soc. for the Year 1917, Honolulu*, iii, no 5, April 1918, pp. 430–457, 1 plate.

The probable evolution of the species of Psyllids found in Hawaii is discussed. A synopsis of the genera is given and a key to the species occurring in the Islands.

FULLAWAY (D. T.). **A New Genus of Pteroptricine Aphelininae (Hymenoptera).**—*Proc. Hawaiian Entom. Soc. for the Year 1917, Honolulu*, iii, no 5, April 1918, pp. 463–464.

Pseudopteroptrix imitatrix, gen. et sp. n., is described, having been bred from the scales, *Howardia biclavis* and *Aspidiotus rapax*. It is compared with *Pteroptrichoides perkinsi*, Fullaway, bred in 1913 from *Leucaspis indica* (?) on a Bombay mango, and, since then, from *Morganella longispina*.

BRIDWELL (J. C.). **Notes on the Bruchidae and Their Parasites in the Hawaiian Islands.**—*Proc. Hawaiian Entom. Soc. for the Year 1917, Honolulu*, iii, no. 5, April 1918, pp. 465–505.

No Bruchid is endemic to the Hawaiian Islands, but various species have become established there and several have been intercepted in quarantine. A key is given to the species found in Hawaii, which include: *Bruchus obtectus*, Say (common bean bruchus); *B. chinensis*, L. (cowpea bruchus); *B. quadrimaculatus*, F. (four-spotted bean bruchus); *B. prosopis*, Lec. (mesquite or algaroba bruchus); *Pachymerus* (*Caryoborus*) *gonagra*, F. (tamarind bruchus); *B. pruininus*, Horn; an undetermined species closely related to *B. ornatus*, Boh., which is referred to in this paper as the Dolichos weevil; and a small species perhaps identical with *Spermophagus* (*Zabrotes*) *pectoralis*, Sharp. Besides these, *B. pisorum*, L., and *B. rufimanus*, Boh., occur frequently in imported peas (*Pisum sativum*) and broad or horse beans (*Vicia faba*).

Bruchus pruininus was swept from beneath bushes of *Leucaena glauca*, and has since been bred in large numbers from its seeds. Eggs of this species have also been found deposited upon the seeds of indigo (*Indigofera anil*) and attacking the seeds of *Sesbania sesban* in the open. In California it is recorded as breeding in the seeds of the desert iron wood (*Olneya tesota*), black locust (*Robinia pseudacacia*) and

some introduced species of *Acacia*. *B. pruininus* has been induced in captivity to oviposit upon 44 species of seeds, which are given in a table; of these probably only *Desmanthus virgatus* and *Albizzia saponaria* will be found infested naturally. The adults in nature visit the flowers of the host-plants and feed on the pollen; they probably live for a month or more. None of the plants upon which *B. pruininus* breeds in Hawaii is of any particular economic value at present; whether it will continue to breed in stored seeds indefinitely remains to be seen.

The Dolichos weevil has been bred from the beans of a white variety of *Dolichos lablab* which is used to some extent as food. The eggs are laid in masses on the pods while these are still quite green; all the larvae from an egg-mass enter a single bean and develop there, practically destroying it during their development. The greatest number of adults emerging from any one bean was 14; they make their exit from the pod by cutting circular openings similar to those made in emerging from the bean. Though *D. lablab* is the usual host, eggs have also been found on pods of the lima bean (*Phaseolus lunatus*). In captivity it has been bred from pigeon pea [*Cajanus indicus*], cowpea [*Vigna sinensis*], soy bean [*Glycine hispida*], chick pea [*Cicer arietinum*], adsuki bean [*Phaseolus angularis*], broad bean, mung bean [*Phaseolus aureus*] and common pea. It could not be induced to breed in common beans. This beetle is short-lived in confinement, and the author doubts whether it will succeed in maintaining itself in storage; 40 to 55 days seems to be the period required for its development from egg to adult during the cooler part of the year in Honolulu.

Bruchus obtectus has been frequently bred from stored beans; eight or ten generations may be produced in a year, breeding being continuous in stored beans infested while in the field. Lima and tepary beans [*Phaseolus acutifolius* var. *latifolius*] are readily infested experimentally and the former have been found appreciably injured in the field. Individuals developing from Lima beans are found to be smaller than those from common or tepary beans; this is true also of *B. quadrimaculatus* and the Dolichos weevil bred from this host.

Bruchus chinensis has been recorded previously breeding in various peas and beans; in Hawaii it frequently attacks pigeon peas in the field, eggs being laid either on the unbroken pod or, if the pod has burst open, upon the peas. Adults developing from these eggs mate and oviposit before cutting their way out of the pod. The author has secured oviposition upon 40 species of leguminous seeds, adults having been bred from *Phaseolus articulatus*, *P. aureus*, *Vigna sinensis*, *Cajanus indicus*, *Glycine hispida*, *Cicer arietinum*, *Vicia faba* and *Pisum sativum*. Attempts to secure breeding in common beans, lima and tepary beans, all failed. *B. chinensis* requires only 29 days to complete its life-cycle during the winter season. In storage, seeds are found much more heavily infested with *B. quadrimaculatus* than with *B. chinensis*, though why this should be is not known, since when adsuki beans were placed with large numbers of adults of both species, many examples of *B. chinensis* emerged from the infested beans.

Bruchus quadrimaculatus has been recorded only as a pest of stored beans and peas, and has in no case been found ovipositing upon the

pods of its host-plants in the field. The same is recorded from India, though in North America it readily attacks its host in the field. It has been recorded as breeding in stored cowpeas and peas and the author has bred it experimentally from the same hosts as those recorded for *B. chinensis* and also from *Phaseolus lunatus*, *P. acutifolius*, *Vigna lutea*, *Dolichos lablab* and *D. sudanensis*; from 40 to 50 days is required for the life-cycle during the winter season in Honolulu.

Bruchus prosopis has been known for many years in Hawaii as a serious enemy of algaroba (*Prosopis juliflora*). It has also been recorded as breeding in pigeon peas. Normal oviposition of this species was difficult to secure experimentally; apparently the female deposits eggs through accidental openings in the cuticle and fibrous layer of the pod.

A species of *Spermophagus* has been found infesting various beans grown on the Agricultural Experiment Station grounds; these had been infested during storage and were very much damaged. If, as the author suspects, the Bruchid concerned is *Spermophagus* (*Zabrotes*) *pectoralis*, Sharp, it has been previously bred from beans and cowpeas. The author has reared it experimentally from *Phaseolus vulgaris*, *P. lunatus*, *P. articulatus*, *P. acutifolius*, *Vigna chinensis*, *Cajanus indicus*, *Glycine hispida*, *Cicer arietinum* and *Pisum sativum*.

Pachymerus (*Caryoborus*) *gonagra* breeds in the seeds of several trees and shrubs, including *Tamarindus indicus*, *Cassia nodosa*, *C. fistula*, *C. grandis*, *Acacia farnesiana*, *Prosopis juliflora*, *Bauhinia tomentosa*, *B. monandra* and *Caesalpinia pulcherrima*. Eggs are laid indiscriminately on the pods of its host-plants, sometimes on the seeds and frequently in other places where the larva has no chance of finding food. The larval stage is passed within the seed; this, however, is usually too small to contain the pupal cell, which is therefore constructed partly within and partly outside the seed, by scraping away a circular patch on the pod until only a thin membrane remains, through which the adult emerges.

Parasites of Bruchids in Hawaii include *Uscana semifumipennis*, a Trichogrammatid egg-parasite that has been established for some years and is now parasitising about 90 per cent. of *Pachymerus gonagra*, and also attacks the eggs of *Bruchus pruininus*, *B. chinensis* and the Dolichos weevil; it probably attacks any species that deposit their eggs on the surface of pods and seeds in the field and constitutes a valuable addition to the parasitic fauna of the Island, particularly as it seems to be the only known egg-parasite of Bruchids.

A Braconid, *Heterospilus prosopidis*, was bred from sweepings of *Bruchus pruininus*, and has since been bred in Honolulu from *B. prosopis* in the pods of *Prosopis juliflora*, from the Dolichos weevil in the beans of *Dolichos lablab* within the pods, from *B. pruininus* in the seeds of *Leucaena glauca* on the ground, and from *B. chinensis* in pigeon peas. The method of oviposition is described; as the host can only be attacked during the short period when the membrane of the pod is sufficiently thin for the short ovipositor of *H. prosopidis* to penetrate it and reach the host, the extent of parasitisation only reaches 10 to 15 per cent. It cannot therefore be considered of great importance in the control of Bruchids and it is not considered likely to attack them in stored peas and beans. In captivity, *H. prosopidis*

will oviposit in the cocoon of *Pachymerus gonagra*, though it is not known whether it will develop at the expense of this host, nor whether it will attack it in nature. Probably it will attack other species of Bruchids whenever conditions are favourable in the field. Three distinct larval stages have been observed in *H. prosopidis* and there are doubtless one or two intermediate stages. The full-grown larva spins its cocoon within the pupal chamber of the host and the adult emerges from the seed or pod of the host plant through a circular emergence hole somewhat smaller than that of the host. *H. prosopidis* varies in size in accordance with that of its host, those from *B. prosopis* (the largest of its local hosts) being much larger than those from *B. pruininus*.

A species of *Scleroderma* bred from *Pachymerus gonagra* was found to differ from the known Hawaiian species that are endemic and parasitic upon Lepidopterous larvae; this is believed to be an immigrant species, perhaps from the Orient, and is here described as *Scleroderma immigrans*, sp. n. This species does not parasitise more than about 10 per cent. of the cocoons of *P. gonagra* in the locality examined, and it is not recorded elsewhere in Honolulu upon this host. Five adults of a Eupelmine have been bred from *Bruchus prosopis*, and the same parasite has been bred from *B. pruininus* under natural conditions, and also from cocoons of *Pachymerus gonagra*. This species, originally described as *Eupelminus swezeyi*, Crawf., differs so much from the type of the genus that a new one, *Charitopodinus*, is created for it. The author takes the opportunity of describing a new species of this genus from China, *Charitopodinus terryi*, sp. n. It is doubtful whether *C. swezeyi* is more than an occasional parasite of Bruchids.

Pteromalids attacking Bruchids include a species doubtfully referred to *Pteromalus calandrae*, bred from *Bruchus quadrimaculatus* infesting pigeon peas in storage; this species has also been bred experimentally from the Dolichos weevil and from *Bruchus chinensis*. The early larval life is spent as an internal parasite of the Bruchid larva; when nearing maturity the Pteromalid larva emerges from its host and completes its development externally. Another undetermined Pteromalid has been bred from *Bruchus pruininus* in seeds of *Sesbania sesban* hanging in partly opened pods on the tree.

A mite, *Pediculoides ventricosus*, is found to cause much destruction among all stages of many Bruchids, as well as of their parasites. These mites affect the beetles more generally in some seeds than in others, according to whether the texture of the seed permits ready entrance or not. Any introduction of the larval parasites of Bruchids would have to be carried on with particular care in order to reduce the attacks of this mite upon them.

This paper concludes with observations on the oviposition habits of Bruchids with special reference to the fact that this is often effected in totally unsuitable places, while species such as *Bruchus pruininus* deposit eggs on *Ipomoea* seeds, castor beans, and seeds of *Cassia glauca*, in which the larvae cannot survive, or on indigo seeds which produce only an undersized adult. This characteristic may enable the species to live on unusual food when its own food-plant fails, and may also permit a wider dispersal of the insect.

Certain Bruchids are remarkable for attacking the seeds of palms;

Pachymerus (*Caryoborus*) *curvipes* attacks several species of palm nuts, including the coconut; *P.* (*C.*) *bactris* and *P.* (*C.*) *luteomarginatus* have been bred from the seeds of the palm, *Copernicia cerifera*, and an undetermined species—like the others, from South America—destroys the vegetable ivory nut (*Phytelephas macrocarpa*), while the North American *P.* (*C.*) *arthriticus* feeds in the larval stage in the seeds of palmetto [*Sabal palmetto*].

The Bruchids are without doubt descended from a Chrysomelid group in which the larvae attacked the green pods of legumes, and the oviposition of such species as *B. obtectus*, the eggs of which are laid in the crevices of pods of the host-plant, may perhaps represent the primitive method of egg-laying, from which later forms developed in which the eggs were cemented to the larval food. It seems evident that the evolution of the Bruchids has proceeded in directions limited by the peculiarities of the Leguminosae, and there is an interesting field for work in the investigation of the factors that limit the attacks of the different species. Bruchid injury is undoubtedly largely influenced by the structure of the pods and their behaviour upon ripening. Thus, *Prosopis juliflora* is not naturally attacked by *Bruchus pruininus* because of its non-dehiscent pods, but it readily breeds in these seeds when the coverings are artificially removed; and this is also true of the peanut [*Arachis hypogaea*] and of *Desmodium uncinatum*. *B. pisorum* apparently always oviposits upon the pods, *B. pruininus* apparently always upon the seed, while the Dolichos species, *B. chinensis* and *Pachymerus gonagra*, may oviposit upon either the seeds or pods. *Bruchus pisorum* oviposits only upon the green pods of its host-plants; these plants are but rarely cultivated in the Islands and if this species should be imported in peas it would seldom be able to find conditions under which it could breed. This may be the reason for its not yet having became established.

A table is given showing the results of experiments with various seeds.

BRIDWELL (J. C.). **Insects in Relation to Problems of Storage of Food in Hawaii.**—*Proc. Hawaiian Entom. Soc. for the Year 1917 Honolulu*, iii, no. 5, April 1918, pp. 506–509.

A considerable number of species of insect pests of stored-food occur in Hawaii; in the present paper they are not considered separately, but since they re-act in different ways to the process of sterilisation, the measures resorted to must be adjusted to the most resistant. The most likely place for infestation is in the mill; the store and the home are generally less dangerous. An increasing number of mills and factories sterilise their products before they are placed on the market. Since food may become infested either by the adult insect gaining access to the food and ovipositing thereon, or by the larvae entering through crevices in the containers, it is essential that all stages of the insect must be destroyed in the food, and re-infestation from without must be prevented. The most successful methods of destruction of insects in food are sterilisation by dry heat and fumigation with carbon bisulphide or with hydrocyanic acid gas. If any insect is subjected to a temperature of 110° F. long enough for the heat to penetrate its tissues, it dies; in practice it is desirable to use somewhat

higher temperatures so as to secure quicker penetration of the food material by the heat. Peanuts in loose piles can be successfully sterilised without injury if they are subjected to a temperature of 125° F. for 6 hours. Small quantities of cereals and flour can be sterilised in an oven, provided that the heat used is not sufficient to cause scorching. If the dried foods imported into the Islands could be sterilised in a properly constructed plant before being distributed to the stores, much of the present loss would undoubtedly be obviated. Occasionally food can be sterilised by spreading it out on a dark background exposed to direct rays of the sun. This method has been used with some success in the case of weevil-infested beans. Moist heat is seldom successful on account of its tendency to produce mould in the food.

An objection to fumigation is the uncertainty of its effects, and the fact that it is not an advisable method where long continued storage is required. Carbon bisulphide, in the proportion of 2 lb. per 1,000 cubic feet, kept in tight receptacles for not less than 48 hours, will ordinarily sterilise bags of grain, destroying all insects. Hydrocyanic acid gas fumigation, which is too dangerous to be recommended for home use, has a high penetrating power and is a much more deadly poison than carbon bisulphide. For fumigation in mills, the amount of gas produced by 1 oz. potassium cyanide and 1 oz. sulphuric acid in 3 oz. water for each 1,000 cubic feet, has given satisfactory results. A sterilised food product will, however, become re-infested in Hawaii within a few months, if not protected in some manner, unless sterilised in hermetically-sealed tin containers.

The author points out the necessity of the problems discussed in this paper being studied by an entomologist who could devote his entire time to the subject, our present knowledge being confined to the incidental observations of those who are devoting the greater part of their attention elsewhere.

FULLAWAY (D. T.). **Division of Entomology.**—*Hawaiian Forester & Agriculturist. Honolulu*, xv, no. 3, March 1918, p. 64. [Received 18th June 1918.]

During the month of February the insectary handled35, 300 pupae of the melon fly [*Dacus cucurbitae*], from which were bred 1,214 individuals of *Opius fletcheri*. The parasites distributed included: *O. fletcheri*, 1,032; *Diachasma fullawayi*, 280; *D. tryoni*, 330; *Opius humilis*, 25; *Paranagrus* (corn leaf-hopper parasite), 17,350.

LOUNSBURY (C. P.). **Division of Entomology. Annual Report, 1916-1917.**—*Union S. Africa Dept. Agric. Rept., Cape Town*, 1918, pp. 93-105. [Received 17th June 1918.]

Nursery inspection during the year resulted in quarantine being applied to 15 nurseries in which red scale [*Chrysomphalus aurantii*] was the chief source of trouble, being the only cause of quarantine in 9 cases, and partly the cause in 4 others, while pustular oak scale [*Asterolecanium variolosum*] led to quarantine in one other case.

Chrysomphalus dictyospermi (Spanish red scale) has been found on peach, mango, avocado pear, guava, rose and a number of other

ornamental plants, but not on citrus, though originally placed on the quarantine list as a potential pest of citrus. Pernicious scale [*Aspidiotus perniciosus*] having been found in one of the Pretoria nurseries, all susceptible plants from the threatened premises were inspected and fumigated before leaving the area. No change in the rules and regulations governing the introduction of plants and fruits from overseas were made during the year, except in the case of potatoes. The regulation prohibiting the importation of apple stocks took effect from 1st October 1916.

Pests intercepted during plant inspection included *Aspidiotus pyri*; *A. ostreaeformis*; *Eulecanium* (*Lecanium*) *bituberculatum*; *Pulvinaria ostulae* on fruit-tree stocks from France; *Lecanium* sp. on currants; *Aulacaspis pentagona* on wistaria; and *Selenaspidus articulatus* on an unrecognised plant; *Chrysomphalus aonidum* (*ficus*) on palms; and several unidentified scales on other plants. The usual pests were intercepted on imported fruit, including codling moth (*Cydia pomonella*) in apples, and red scale [*Chrysomphalus aurantii*], oleander scale [*Aspidiotus hederae*], mussel scale [*Lepidosaphes*], *Parlatoria pergandei*, *P. zizyphus*, *Chrysomphalus aonidum* and *C. dictyospermi* (Spanish red scale) on citrus fruit.

The regulations restricting the removal of apples, pears and quinces into certain areas of the Union as a means of retarding the spread of *C. pomonella* were extensively amended and these areas have since been further contracted, a revised poster acquainting the public with such regulations being published in May 1916. This moth, having now spread into practically all districts where the growing of apples and pears is an industry of real importance, it is doubtful if any good purpose is served by these regulations.

The migratory red locust (*Cyrtacanthacris* (*Schistocerca*) *septemfasciata*) was apparently absent from S. Africa during the season, 1916–17. The closely allied N. African migratory locust, *Schistocerca peregrina*, was troublesome in Egypt and British East Africa. It is not known whether these species overlap in distribution, but it was probably one of them which was reported by troops in German East Africa.

Locusta pardalina (brown locust), the common migratory locust of inland parts of the Union, was again widespread, though, taken as a whole, the outbreaks of the pest were not nearly so severe as in the previous season. Provisions of the Agricultural Pests Act, 1911, impose on occupiers of land the destruction of immature locusts that occur thereon, in consultation with, and on the advice of the Department of Agriculture, the material for such destruction being provided by the Department free of charge, and consisting of a sweetened solution of sodium arsenite and the loan of bucket pumps [see this *Review*, Ser. A, v, p. 545].

L. pardalina normally hibernates in the egg-stage, and hatching occurs when warm weather sets in and the soil is well moistened, and is therefore dependent on the rains. The flying stage is reached in about 6 weeks, when mating takes place, oviposition occurring a a few weeks later. There are usually two generations in the year, the number being controlled by moisture and temperature conditions. In the year 1916–17 a third brood is thought to have developed in some localities. This locust is pre-eminently gregarious and until

within the last few years was not suspected of living in a solitary state; single specimens met with were thought to be stragglers from swarms. Recent observations have shown, however, that the insect not uncommonly lives a solitary, or practically solitary, existence throughout life, individuals in various stages of development having been found singly 50 miles and more from where any swarms had been known for years. These examples are often distinguishable from typical swarm individuals by the possession of protective colouration. The conclusion has been gradually reached that swarms arise by a rapid increase and gathering together of solitary locusts. Small swarms tend to appear in semi-arid parts of the country in the season following the break-up of a very prolonged drought. The first observed swarms are usually loosely formed, and occur at the same time as numerous clusters and solitary specimens, all apparently of local origin. In the following season an extensive visitation of typical swarms may be expected, the position being complicated by migrations of swarms from one part of the country to another, many outbreaks being due entirely to migrants from a distance.

A repetition of the extensive outbreak of 1915–16, when about 28,000 swarms were destroyed, was expected the following year from eggs deposited by the swarms that escaped in numerous localities over an area of about 100,000 square miles, and preparations were made accordingly. The outbreak that materialised was less severe and less widespread than was expected. A table showing its incidence is given, covering the whole locust season from August 1916 to June 1917.

Natural enemies exercised but little control during the season. *Wohlfahrtia brunnipalpis*, Mcq. (locust fly) was observed issuing from egg-deposit sites in one area of severe infestation, but the thorough destructive work necessary involved the sacrifice of this parasite. Large locust birds (storks) were not uncommon in some districts, but only a few were reported from the locust-infested area. Baboons were credited with considerable beneficial work in one area.

The poison mixture supplied by the Department of Agriculture consisted of 5 lb. sodium arsenite, 80 per cent. strength, dissolved in half a gallon of water and mixed with a solution of 10 lb. sugar in one gal. water. In use this syrup was diluted in the proportion of one part to 50 parts water, at which strength it acts as a stomach poison, killing a locust in from 1 to 4 days. Farmers, however, often use it at a greater strength, when it acts as a contact insecticide, but this use is to be deprecated owing to the risk of poisoning stock.

The cost to the Government of the 1916–17 campaign was fully £8,000, and this should be considered largely as insurance against damage that might have been done by the resulting migrating swarms, and as a measure against an overwhelming visitation of the plague in the following season, the destruction of a single swarm in one season preventing the equivalent of at least fifty such swarms the following year. Actually, very little damage was done to crops by the insects, and no losses of stock through accidental poisoning were recorded.

Field and laboratory studies, the results of which have not yet been published, have been continued on the structure and economy of termites; the South African Coccids; the control of the house ant, *Pheidole punctulata*, in Pretoria; and life-cycle studies of *Plutella*

maculipennis (small cabbage moth), *Colias electra* (lucerne caterpillar) and *Argyroploce* (*Enarmonia*) *batrachopa* (false codling moth). It is hoped to make similar studies during the following year on *Phryneta spinator* (fig borer) and *Bagrada hilaris* (bagrada bug). As the effective disposal of maize stumps before spring is necessary as a remedial measure for the maize stalk borer [*Busseola fusca*], much time has been spent in devising and developing mechanical appliances for uprooting and raking up maize stumps, and a comprehensive report on this pest will shortly be published. Combined field and systematic study of the Bruchid enemies of peas and beans has been continued, and parasitised material of *Saissetia* (*Lecanium*) *oleae* (black scale) has been collected and despatched to the Horticultural Commissioner of California, this work being now suspended owing to the irregular sailings due to the War.

In Natal, special studies on insects injurious to the wattle were conducted. The wattle bagworm [*Chalioides junodi*] was not so abundant as in the previous year, and contemplated experiments with poison-dust, applied with a motor-driven blower, could not be completed, though results to date justify the adoption of dusting as a cheap and effective means of controlling this insect in plantations.

Cogan (E. S.). **Entomological Education in the United States.**—*S. African Jl. Sci., Cape Town,* xiv, no. 8, March 1918, pp. 345-349. [Received 17th June 1918.]

The amazingly rapid development of the agricultural resources of the United States, and the knowledge of the rôle which insects play in the transmission of disease, have created a demand for trained entomologists to cope with the many diverse insect problems concerned. To meet this demand the universities and colleges have instituted special courses of instruction, so that America may now justly claim to be the home of applied entomology.

This paper aims at giving some idea of the courses arranged and where they may be best obtained, together with particulars of some of the extensive opportunities offered.

Schlupp (W. F.). **The Potato Tuber Moth.**—*Union S. Africa Dept. Agric., Pretoria,* Bull. no. 4, 1917, 11 pp., 2 figs. [Received 18th June 1918.]

Phthorimaea operculella, Zell. (potato tuber moth) is the worst pest of potatoes in South Africa. The present pamphlet is published in answer to numerous inquiries regarding this insect, and is the result of three seasons' observations. Tobacco is also attacked, but the damage is less severe. The life-history and descriptions of the various stages are given, and the methods of infestation are discussed. Moths may reach the tubers through cracks in the soil, and also attack those that are only partly covered. The greatest infestation probably occurs through the larvae leaving the tops when the latter begin to wilt, or when cold weather occurs, and boring down into the soil and attacking the tubers. In some localities as many as 50 per cent. of the larvae in the leaves were found to be parasitised by an Ichneumonid,

Omorgus phthorimaeae. Spraying has not proved successful, owing to the manner of feeding of the larvae. The various preventive measures have already been noticed [see this *Review*, Ser. A, v, p. 35, & vi, p. 292].

WILSON (H. F.). **Aphid Notes from British Columbia.**—*Proc. B. C. Entom. Soc., Victoria, B.C.*, no. 5, January 1915, pp. 82–85, 15 figs. [Received 17th June 1918.]

The Aphids dealt with in this paper include:—*Macrosiphum stanleyi*, sp. n., from the under-side of leaves of *Sambucus glauca*; *M. frigidae*, Oestl., on *Artemisia* sp.; *M. rudbeckiae*, Fitch, on *Solidago* sp.; *M. urticae*, Schr., on *Urtica dioica*; *M. ludovicianae*, Oestl., on *Artemisia ludoviciana*; *M. rosae*, L., on *Rosa* sp.; *Nectarosiphum rubicola*, Oestl., on *Rubus* sp.; *Myzus cerasi*, F., on wild cherry; *Aphis cerasifoliae*, Fitch, on choke cherry; *A. sorbi*, Kalt., on apple; *A. avenae*, F., on apple; *A. cardui*, L., on *Carduus* sp.; *Hyalopterus arundinis*, F., on *Prunus* sp.; *Melanoxantherium smithiae*, Monell, on *Populus* sp.; *Cladobius ? populneus*, Kalt., and *Arctaphis populifolii*, Essig, on *Populus* sp.; *Chaitophorus aceris*, L., on *Acer* sp.; *C. negundinis*, Thomas, on *Acer negundo*; *Euceraphis betula*, Fitch, on Eastern birch; and *Phyllaphis fagi*, L., on *Fagus* sp. (imported).

Myzaphis (*Aphis*) *abietina*, Wlk., of which a description is given, was first noticed in 1914 on spruce trees in Vancouver, where its presence caused the fall of practically all the previous year's needles. Later in the season it migrated to an alternate bost.

WILSON (T.). **The Oyster-shell Scale.**—*Proc. B. C. Entom. Soc., Victoria, B.C.*, no. 5, January 1915, pp. 96–97, 1 plate. [Received 17th June 1918.]

Of the various scale-insects infesting orchards and forests, none has so varied a list of host-plants, and few have so wide a geographical range, as *Lepidosaphes ulmi* (oyster-shell scale). Tbis paper gives a list of its host-plants in British Columbia, including apple, pear, crab apple, mountain asb, rose, *Spiraea discolor*, *Prunus emarginata*, hawthorn, *Amelanchier alnifolia*, Japanese quince, *Cornus nuttalli*, *C. stolonifera*, laburnum, willow, poplar, ash, beech, elm, privet, lilac, box and *Rhamnus purchiana*.

It has been found at all altitudes from sea-level up to 3,000 feet, but fortunately it is exceedingly subject to parasitism and reproduces slowly, hence it is naturally held in check.

CAESAR (L.). **Insecticides and Fungicides.**—*Ontario Vegetable Growers' Assoc. 13th Ann. Rept., 1917*; *Toronto*, 1918, pp. 29–32.

This paper discusses the comparative values of various insecticides, including Paris green. lead arsenate and calcium arsenate, sodium arsenate and arsenite and tobacco extracts.

MURPHY (P. A.). **Dusting *v.* Spraying in Nova Scotia.**—*Canadian Horticulturist, Toronto*, xli, no. 5, May 1918, pp. 113–114, 1 fig.

Experience has shown that fruit from orchards that have been dusted will be somewhat more free from the attacks of biting insects

than sprayed fruit, but on the other hand it will be more spotted with apple scab. The extent to which this will develop in spite of dusting will depend on the season, the fruit being efficiently protected by this method in all but the severest outbreaks. This being so, owners of large orchards may be advised to take the risk of loss during a year of exceptional scab infestation, the risk being more than counterbalanced by the advantage gained by covering the whole orchard often and at the proper time. The small fruit-grower, on the contrary, might be well advised to adhere to the slower, but rather more certain method of liquid applications.

SANDERS (G. E.). **Control of Orchard Insects.**—*Canadian Horticulturist, Toronto,* xli, no. 5, May 1918, p. 118.

Fungicides mixed with poison solutions exert a very appreciable influence on the killing value of sprays. Bordeaux mixture added to the average poison decreases its killing value by about 50 per cent. When rapid killing is desired and a fungicide is necessary, a poisoned Bordeaux spray may be made of :—1 lb. sodium arsenate dissolved in water, the solution being used to slake 5 lb. fresh stone lime and then made up to 20 gals. ; 4 lb. copper sulphate is then dissolved in another 20 gals. water and the two are poured together. The sodium in this combination causes the arsenic to act rapidly, offsetting the action of the Bordeaux in this respect.

Lime-sulphur and barium tetrasulphide reduce the killing value of poisons by 15 to 20 per cent., an amount which is negligible in practice. When large quantities of poisons must be used against biting insects, it has been found injurious to the foliage to add large quantities of fungicides to them, as the lead arsenate so used breaks up and forms so much soluble arsenic, while calcium arsenate used in excess is not sufficiently protected from the air by the sulphide solution.

Sodium sulphide and potassium sulphide, on the contrary, increase by from 10 to 15 per cent. the killing value of poisons that can safely be used with them. This makes sodium sulphide a most valuable carrier for poisons where outbreaks of canker worms and such insects have to be dealt with, a mixture of 2 lb. soluble sulphur and 2 lb. calcium arsenate to 100 gals. water having been used in such outbreaks with the greatest success, the only ill-effects from one application being 1 to 10 per cent. of yellow leaf. In ordinary practice a decrease of the amount of calcium arsenate with sodium sulphide to $1\frac{1}{4}$ lb. per 100 gals. and the addition of 15 to 25 lb. hydrated lime is recommended.

In cases of outbreaks of biting insects applications of simple lead arsenate are recommended rather than combinations, and this at the rate of 10 to 15 lb. standard paste soon after the larvae emerge. As this strength of lead arsenate is at least equal to lime-sulphur or soluble sulphur as a fungicide, it may safely be used alone at double or triple strength at any of the five spraying periods when an outbreak of biting insects is threatened.

The killing value of four standard poisons which, when they are used alone, is 100 per cent., when they are mixed with sodium sulphide is 113·1 per cent. ; with lime and sulphur is 80·8 per cent. ; and with Bordeaux is 56·5 per cent.

Criddle (N.). **The Egg-laying Habits of Some of the Acridiidae (Orthoptera).**—*Canadian Entomologist, London, Ont.*, l, no. 5, May 1918, pp. 145–151.

The oviposition habits of several grasshoppers are here described, including :—*Arphia pseudonietana*, Thom., *Camnula pellucida*, Scudd., *Dissosteira carolina*, L., *Spharagemon collare*, Scudd., *S. bolli*, Scudd., *Melanoplus atlantis*, Riley, *M. angustipennis*, Dodge, *M. packardi*, Scudd., and *M. bivittatus*, Say.

Gahan (A. B.). U.S. Bur. Entom. **An Interesting New Hymenopterous Parasite.**—*Canadian Entomologist, London, Ont.*. l, no. 5, May 1918, pp. 151–152.

A Dryinid, *Aphelopus theliae*, sp. n., a parasite of the Membracid, *Thelia bimaculata*, F., is described from New York. Specimens were reared from larvae that bored through the sternites of the parasitised host, dropped into jars of moist earth and there pupated. From a single individual of *T. bimaculata*, 50 to 70 larvae emerged, this being a polyembryonic form. Oviposition takes place in early June, a single egg being deposited within a nymph of *T. bimaculata*. Full-grown larvae emerge from the middle to the end of July.

Garnett (R. T.). **An Annotated List of the Cerambycidae of California (Col.).**—*Canadian Entomologist, London, Ont.*, l, no. 5, May 1918, pp. 172–177.

This paper forms the first part of a list of Californian Cerambycids. Among the species of economic importance are: *Ergates spiculatus*, Lec., from yellow pine; *Prionus californicus*, on the roots of the coast live oak (*Quercus agrifolia*); *Tragosoma depsarium*, L. (*harrisi*, Lec.) on tamarack and yellow pine and other coniferous trees; *Asemum atrum*, Esch., breeding in *Pseudotsuga taxifolia* (Douglas fir); *A. nitidum*, Lec., on *Pinus radiata*; *Criocephalus productus*, Lec., *Tetropium velutinum*, Lec., and *Opsimus quadrilineatus*, Mann., breeding in *Pseudotsuga taxifolia*; *Hylotrupes amethystinus*, Lec., breeding in *Pinus ponderosa* and *Libocedrus decurrens*; *H. ligneus*, F., breeding in *Pseudotsuga taxifolia*, *Pinus radiata*, and probably in *Sequoia sempervirens*; *Phymatodes obscurus*, Lec., breeding in *Quercus agrifolia* and *Q. lobata*; *P. aeneus*, Lec., *P. dimidiatus*, Kirby, and *P. varius*, F., from *Pseudotsuga taxifolia*, and the last-named also from *Pinus radiata*; *P. decussatus*, Lec., reared from white valley oak; *P. nitidus*, Lec., from *Cupressus macrocarpa*, *Sequoia sempervirens* and *Pseudotsuga taxifolia*; and *Callidium antennatum*, Newm., breeding in most coniferous trees, especially *P. taxifolia*.

Criddle (N.). **The Habits and Control of White Grubs in Manitoba.**—*Agric. Gaz. Canada, Ottawa*, v, no. 5, May 1918, pp. 449–454, 4 figs.

The white grubs occurring in the province of Manitoba are *Lachnosterna anxia*, Lec. (*dubia*, Sm.), *L. nitida*, Lec., *L. drakii*, Kirby (*grandis*, Sm.), and *L. rugosa*, Melsh. Although these are at no time a very serious pest, they are of considerable economic importance as destroying growing grain, grasses and certain vegetable crops. The

adults or June beetles do much damage to the foliage of trees and shrubs.

L. anxia appears in the adult form in mid-May, about the time when willows and aspens are bursting into leaf. Eggs are generally laid in June, being deposited singly in small cavities at a depth of 1 to 4 inches. This species prefers rich soils or lowlands, such as river flats. The larvae live chiefly on decayed vegetation for the first season; during their second summer they are only destructive if very numerous. During the third season the insect feeds on living roots and may damage many kinds of crops. By June of the third year the larva is generally mature and pupates close to where it has been feeding. The adults generally remain in the pupal chamber until the time of emergence in the following spring. The life-histories of the other species differ from that of *L. anxia* only in certain particulars. *L. nitida* appears rather later than *L. anxia*, and generally prefers a drier soil; the adults seldom leave the open groves where they breed. Aspens are apparently the favourite food, though elms also are attacked. *L. drakii* is the largest species found in Manitoba; the beetles appear towards the end of August, their chief food consisting of aspens and oak. *L. rugosa* is by far the most abundant species on sandy soils. Beetles emerge soon after the trees come into leaf, their food-plants being apple, plum, wild cherry, thorn, rose, elm, maple, oak and aspen, especially the last-named. Eggs are found at depths varying from 1 to 7 inches and hatch in late July and early August.

White grubs pass the winter at varying depths beneath the soil surface; the larva of *L. anxia* hibernates at a depth of 44 in. in dry woods and from 14 to 25 in. in wet situations. The average depth for *L. nitida* is 34 inches, for *L. rugosa* 74 inches and for *L. drakii* about 40 inches. In some species the adult beetles, as well as the larvae, burrow down into the soil in winter. While the other Manitoba species remain in the pupal chamber or burrow slightly below it, *L. rugosa* begins to burrow soon after the beetles mature, that is about 1st September, and by the approach of winter is found at an average of 29½ in. below the soil surface.

As a control measure, ploughing should be done between 14th May and 1st July, to an average depth of 5 in., in order to expose the maximum number of grubs, eggs or pupae. The majority will probably be devoured by birds, but for the remainder the ground should be harrowed soon after ploughing so that the egg-cells may be broken. Wheat should not be sown upon such ground, but winter rye may be sown, followed by oats. Natural enemies of *Lachnosterna* include robins, blackbirds, cow-birds (*Molothrus ater*), and, above all, crows, which follow the plough eagerly in search of the exposed grubs. Many animals eat white grubs, including the skunk, which more than compensates for its occasional destructiveness to hens' eggs, etc. by digging up the grubs, which it can detect by scent; other animal enemies are badgers, shrews and field mice. Insect parasites reared in Manitoba include the Tachinids, *Cryptomeigenia theutis*, Wlk., which destroyed about 50 per cent. of the beetles in 1914, and *Microphthalma disjuncta*, Wied.; the Dexiids, *Ptilodexia abdominalis*, Desv., and *P. tibialis*, Desv.; *Myiocera cremiodes*, Wlk., (?) has also been found in the grubs. A mite, *Tyroglyphus*

heteromorphus, Felt, has caused the death of many individuals, and hair-worms (*Mermis*) have destroyed about 8 per cent. in recent years. Fungus and other diseases also seem to be responsible for a considerable mortality.

GUITEL (F.). **Entomologie économique. Parasites des végétaux.** [Economic Entomology. Pests of Plants.]—*Insecta, Rennes*, vii, no. 73–84, 1917, pp. 37–38. [Received 17th June 1918.]

Coccus viridis (green scale) is an important pest of coffee in Réunion. Control measures recommended include the attempted introduction of a fungus parasite, as yet non-existent in the island, a method which is worth trying owing to its small cost, and the experimental use of insecticides by the coffee-planters themselves, since the results obtained are so largely influenced by external local factors, such as climate, humidity, etc.

MUMFORD (F. B.). **Work and Progress of the Agricultural Experiment Station for the Year ended 30th June 1916.**—*Missouri Agric. Expt. Sta., Columbia*, Bull. no. 147, June 1917. [Received 18th June 1918.]

The work of the various departments is described. With regard to entomology, investigations are being carried on with different varieties of wheat resistant to the Hessian-fly [*Mayetiola destructor*]; injurious insect pests of melon and related crops are being studied; the life-history, development and habits of the corn-ear worm [*Heliothis obsoleta*] are being investigated, with practical methods for its control. Nurseries are being inspected for the insects that damage the nursery stock, with a view to methods of control being found for them. The scale-insects of Missouri are being systematically studied.

TORREND (C.). **Insect and Vegetable Parasites of the Cacao-Tree in the State of Bahia, Brazil.**—*Mthly. Bull. Agric. Intell. & Pl. Dis., Rome*, ix, no. 4, April 1918, pp. 523–524. (Abstract from *Broteria, Braga*, Ser. Vulg. Scien., Vol. xv, part 6, 1917, pp. 263–279, 4 figs., & Ser. Botanica, Vol. xv, part. 3, pp. 106–127, 1 fig., 4 plates.)

Recently discovered diseases of cacao have been investigated by a Commission in Bahia which is the principal centre of production of this crop. The disease known as rust is caused by *Heliothrips* (*Physopus*) *rubrocinctus*. This Thysanopteron forms colonies on the fruit, in which the larvae puncture innumerable small holes, causing an abundant secretion of the sub-epidermal tissues which eventually covers the whole surface of the fruit. The simplest method of control would be to crush the colonies of the insect. The use of insecticides is difficult owing to the size of the plantations. An ant, which is common in the district and is probably *Dolichoderus bituberculatus*, seems to be a useful enemy of *H. rubrocinctus* and should be protected and propagated, contrary to the present custom.

A Capsid bug closely resembling *Helopeltis antonii*, called provisionally *Mosquilla vastatrix*, because it is believed to be identical with the insect known to Ecuador planters as "mosquilla,"

causes numerous black spots which develop into more or less deep cancerous formations. The insects can be burnt on the fruit with a torch; the ant referred to above probably destroys the eggs of this insect.

The injury to young leaves and buds known as burning, is probably due in a large measure to the action of the adult thrips, and to the holes made by the Capsid. To control these pests, in addition to the methods described, it is advisable to keep the plantation well shaded; the trees attacked should be strengthened by careful pruning.

SILVESTRI (F.). **Notizie sulla Tignola del Melo e sul Verme delle Mele.** [Notes on *Hyponomeuta malinellus* and *Cydia pomonella*.]—*Boll. Lab. Zool. Agrar. R. Scuola Sup. Agric., Portici*, no. 1, 6th September 1917, 11 pp., 5 figs. [Received 6th June 1918.]

In Italy the apple crop sustains an estimated annual loss of about £1,200,000, one-half of the fruit, on an average, being destroyed by *Hyponomeuta malinellus* and *Cydia pomonella*. The latter pest also damages pears and walnuts to the extent of about £240,000. Spraying with lead arsenate (1 per cent. paste or ½ per cent. powder) provides a simple and certain means of reducing these losses very considerably. It is to be hoped that associations will be formed to combat these insects, failing which the formation of such associations may be made compulsory by the prefects under the provisions of the law of 26th June 1913.

Cultivo de la Cebolla. [Onion Cultivation.]—*Rev. Agric., Bogotá*, iii, no. 12, December 1917, pp. 739–742. [Received 7th June 1918.]

In this paper, which is the concluding part of a series on onion cultivation, *Hylemyia antiqua* (*Phorbia ceparum*) is stated to be the chief pest; the measures usually adopted against it are given.

Exportación de Frisoles. [The Export of Beans.]—*Rev. Agric., Bogotá*, iv, no. 1, January 1918, p. 57. [Received 7th June 1918.]

As *Bruchus obtectus*, Say, may prove prejudicial to the exportation of beans from Colombia, fumigation with carbon bisulphide is advised. A short description of the method adopted is given.

MÜLLER-THURGAU (H.), OSTERWALDER (A.) & SCHNEIDER-ORELLI (O.). **Bericht der pflanzenphysiologische und pflanzenpathologische Abteilung der Schweizerischen Versuchsanstalt für Obst-, Wein- und Gartenbau in Wädenswil für die Jahre 1915 und 1916.** [Report of the Department of Plant Physiology and Plant Pathology of the Swiss Experiment Institute for Fruit, Vine and Garden Cultivation at Wädenswil for the Years 1915 and 1916.]—Separate from *Landwirtschaftl. Jahrbuch der Schweiz, 1917*, [*sine loco*], pp. 416–426. [Received 12th June 1918.]

During the two years covered by this report, the number of communications received in connection with fruit tree and garden pests was small compared with the damage done in Switzerland and indicates indifference to remedial measures and ignorance of existing facilities for obtaining information regarding pests.

Among the fruit-tree pests were the following:—*Tetranychus* sp. and *Eriophyes malinus* on apple; *E. tristriatus* on walnut; *E. pyri* and *Epitrimerus pyri* on pear; and *Eriophyes padi* on plum. The Aphids included *Eriosoma* (*Schizoneura*) *lanigerum*, *Aphis mali* and *A. sorbi* on apple; *A. pyri* on pear; and *Hyalopterus arundinis* (*pruni*) on plum. The scale, *Lepidosaphes ulmi*, was found on apple. The bugs, *Orthotylus marginalis* and *Calocoris biclavatus*, are important enemics of the pear, their attacks stunting the fruit and causing it to harden and drop. The larvae should be shaken off the young fruit into pans containing water and petroleum or on to sheets. Spraying with a 3 per cent. solution of soft soap is also useful. The yellow puncture-spots characteristic of injury by *Typhlocyba rosae* were noticed on apple foliage. A number of complaints referred to injury by the caterpillars of *Cydia* (*Carpocapsa*) *pomonella*, *Argyroploce* (*Olethreutes*) *variegana*, *Lyonetia clerkella*, *Leucoptera* (*Cemiostoma*) *scitella* and *Hemerophila* (*Simaethis*) *pariana*. *Hyponomeuta malinellus* occurred on apple, *H. padellus* on plum, and *H. variabilis* on *Euonymus*. *Nygmia phaeorrhoea*, Don. (*Euproctis chrysorrhoea*) was found on pear leaves. *Cheimatobia brumata* was a common pest; some of the Swiss brands of banding glue are satisfactory against it, but require renewing more frequently than the imported material. The caterpillars of *Cossus cossus* and *Zeuzera pyrina* and the larvae of *Contarinia pyrivora* (pear gall midge) and *Perrisia* (*Dasyneura*) *pyri* (pear leaf gall midge) were also sent in. Apple blossom was injured by *Anthonomus pomorum*.

Bark-beetles included:—*Xyleborus* (*Anisandrus*) *dispar* in apple, pear and plum; *X. xylographus* (*saxeseni*) and *Scolytus* (*Eccoptogaster*) *mali* in apple; *S.* (*E.*) *rugulosus* in apple and plum. It was again noted that the plants attacked were those already weakened through other causes. *Melolontha melolontha* was taken from apple, pear and plum roots. *Eriocampoides limacina* injured pear foliage, on which its larvae can be killed by vigorous spraying with a 3 per cent. soap solution. Pupation takes place in the ground beneath the tree and digging up the ground and then treading it down will destroy the majority of the pupae. *Neurotoma flaviventris* (*Lyda pyri*) also infested pear foliage.

Vine pests included *Eriophyes vitis*, *Phyllocoptes vitis*, *Eulecanium* (*Lecanium*) *corni*, *Typhlocyba vitis*, the vine-moths, *Clysia ambiguella* and *Polychrosis botrana*, and the beetle, *Adoxus* (*Bromius*) *obscurus*.

Among the garden pests were:—*Eulecanium corni* on gooseberry and currant, *Chionaspis salicis* on young ash, *Lepidosaphes ulmi* on box, and *Aulacaspis rosae* on rose. The bean aphis, *Aphis rumicis*, the raspberry aphis, *A. idaei*, the potato aphis, *Rhopalosiphum* (*Siphonophora*) *solani*, and *Aphis salviae* from *Salvia* sp. (sage) were received; *Rhopalosiphum rubi* also occurred on raspberry and *R. ribis* on gooseberry. *Phyllaphis fagi* on the beech caused the formation of much sooty fungus. *Pemphigus bursarius* was taken from poplar leaves and salad roots. It sometimes occurs abundantly on the roots of endive and cabbage lettuce, stunting their growth. Migration from the poplar leaves, on which galls are formed, to the salad roots takes place in summer. From a practical point of view the infestation from individuals that have hibernated on salad roots is the more important, but in the case of distant plots infestation

cannot be immediately communicated to salad because all winged individuals return to the poplar and the apterous individuals cannot migrate to neighbouring plots. The practical value of crop rotation is therefore evident. *Chermes* (*Dreyfusia*) *piceae* and *C.* (*D.*) *nüsslini* were taken from *Abies nordmanniana*, while the galls of *C. abietis* were found on *Picea excelsa*, and those of *Prociphilis nidificus* on the roots of silver fir. To protect nursery plants against the last-named they should be lifted and their roots dipped for 5 minutes in a 5 per cent. soap solution. *P. nidificus* is a migratory species, its alternative host being the ash (*Fraxinus*), and if ash trees near the nursery are found to be infested the affected leaves must be cut off and burnt. A closely related Aphid, *Prociphilus bumeliae*, was noticed on the roots of silver fir. Infested firs should be uprooted and burnt. *Trioza alacris* from laurel and *Typhlocyba rosae* from rose were also recorded. The bug, *Stephanitis pyrioides* (*rhododendri*), was recorded for the first time in Switzerland on rhododendrons near Zürich; this species is a well-known rhododendron pest in England and Holland and is said to be a native of Japan. The under-side of the leaves should be sprayed with a 2 per cent. soap solution or—in the case of very valuable plants—fumigation with hydrocyanic acid gas may resorted to. The injuriousness of bugs, such as *Lygus*, has been underestimated; they often occur on geranium, fuchsia and sage. The larvae and pupae of *Cydia* (*Grapholitha*) *pactolana* were taken from *Picea pungens argentea*. Elder and ash were infested by caterpillars of *Gracilaria* (*Xanthospilapteryx*) *syringella*. *Brotolomia meticulosa* was bred from a caterpillar infesting chrysanthemum.

Injurious Diptera included *Phorbia* (*Chortophila*) *brassicae* (cabbage fly); *Anthomyia radicum* on beans; *A. polygoni* on *Polygonum*; *Hylemyia antiqua* in onions; *Lasioptera rubi* on raspberry; *Monarthropalpus buxi* on box; and *Dasyneura schneideri* on *Arabis albida*.

Among the Coleoptera were the cabbage pests, *Ceuthorrhynchus sulcicollis*, *Phyllotreta undulata* and *Psylliodes chrysocephala*; the willow beetle, *Phyllodecta vulgatissima*; *Agriotes* larvae in potatoes; *Melolontha melolontha* larvae on rose; the raspberry beetle, *Byturus fumatus*; *Rhynchaenus* (*Orchestes*) *fagi* on beech; and *Epilachna globosa* on carnations. Larvae of the saw-fly, *Pteronus* (*Nematus*) *ribesii*, defoliated gooseberry.

Information was also sought for regarding the clothes moth, *Trichophaga tapetzella* (*tapetiella*), *Eristalis tenax*, and *Chlorops flavifrons*, all of which were troublesome in houses.

SCHNEIDER-ORELLI (O.). **Weitere Beiträge zur Kenntnis des Kleinen Frostspanners, *Operophthera* (*Cheimatobia*) *brumata*.** [Further Contributions to the Knowledge of *Cheimatobia brumata*.]—Separate from *Landwirtschaftl. Jahrbuch der Schweiz, 1917*, [*sine loco*], pp. 454–463. [Received 12th June 1918.]

The first portion of this paper details experiments with banding against *Cheimatobia brumata* and contains a number of tables showing the captures obtained and again proving the need for banding all trees in an orchard if fully satisfactory results are wanted. The second part deals with the influence of temperature on *C. brumata*, giving information that has already been abstracted [see this *Review*, Ser. A, v, p. 269].

GARMAN (P.). **The Oriental Peach Pest.**—*Maryland Agric. Expt. Sta., College Park*, Bull. no. 209, December 1917, 16 pp., 25 figs. [Received 17th June 1918.]

Cydia (*Laspeyresia*) *molesta*, Busck (Oriental peach moth) has appeared in the District of Columbia and the adjacent counties of Maryland, injuring peach trees by feeding on the terminal buds of the twigs, of which as many as 90–100 per cent. may be killed, though the normal number is from 50 to 70 per cent. When the fruit begins to ripen, the larva frequently leaves the twig and enters the peach near the stem, infesting 5 to 15 per cent. of the fruits. The insect also infests the fruits of apple and quince and the twigs of plum and apricot.

The egg is always laid on the under-side of a leaf, usually at a considerable distance from the initial feeding point of the larva, which often has to travel 6 inches or more to reach suitable food. The incubation period varies from 4 or 5 days at midsummer to 7 days in cool weather. The young larva bores down the core of the twig for an inch or more from the tip, the attack resulting in gummosis, the destruction of the leaves, and the splitting of the twig. The average length of the larval stage is 11 days. When full grown, the larva leaves the twig or fruit and constructs an inconspicuous cocoon, which in summer is found well out on the twigs; the pupal period has an average length of 10 days. The larvae of eggs laid later than 25th August make cocoons hidden in crevices of the bark or in similar places, in which they hibernate, pupating in the spring. The adult is crepuscular, the eggs being usually laid singly during the evening or night, usually only one on a leaf, but often on several different leaves of the same twig.

Since the life-cycle thus occupies about 26 days, it follows that a monthly recurrence of the larval infestation of twigs may occur, and since the earliest noted date of infestation is 22nd May, there is a possibility of 4 broods during the season, provided that a warm September is experienced.

It is supposed that this Tortricid was introduced into the United States through the port of New York about three years previously on flowering cherry, and its dispersal has been caused by the shipment of infested peaches and nursery stock.

Two Hymenopterous parasites attack this pest, the most important of which is the egg-parasite, *Trichogramma minutum*, Riley; the value of this Chalcid lies in the variety of its hosts, which include several common Lepidoptera. In 1917 a count of the eggs of *C. molesta* in the field showed 80 per cent. to be parasitised by *T. minutum*. A second parasite, *Macrocentrus* sp., has been reared from the larva, but only in small numbers.

As regards remedial measures, the most vulnerable stages are those of the egg and early larva, and though it is impossible to keep the young twigs coated with arsenical poison, the young larvae can be prevented from entering the fruit by a thorough application. The pupa cannot be effectively destroyed owing to the character of the cocoon, and the adult apparently cannot be reached by any measure known at the present time. General recommendations for control include the winter application of concentrated lime-sulphur, and

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the summer use of calcium arsenate, ½ lb. to 50 U.S. gals., if combined with self-boiled lime-sulphur and nicotine. If self-boiled lime-sulphur is not used, freshly slaked lime, 4 lb. to 50 U.S. gals. of mixture, should be added. Three applications should be made at monthly intervals, the first being at the time the bloom falls. The complete course of treatment therefore is:—Concentrated lime-sulphur (1 : 9) when the buds swell; self-boiled lime-sulphur (8 : 8 : 50) with calcium arsenate and nicotine after the petals fall, the same mixture being applied 2, 8 and 12 weeks later. Applications of tobacco (nicotine sulphate or Blackleaf 40) and soap cannot be recommended for combating this pest.

Ruggles (A. G.). **Spraying.**—*Minnesota Univ. Farm, St. Paul*, Circ. no. 48, 1st April 1918, 16 pp., 19 figs.

This circular discusses stomach poisons such as lead arsenate, Paris green and hellebore, and gives various formulae for poison-baits. Contact insecticides dealt with include soap solution, tobacco extracts and lime-sulphur.

A new contact insecticide, which shows greater promise than any of the commercial tobacco compounds on the market, is described. This is nicotine oleate and is a combination of a free nicotine extract, such as Nicofume, with commercial oleic acid, often called red oil. Two and a half parts of 40 per cent. free nicotine solution thoroughly mixed with 1¾ parts of red oil will unite to form this material. A 50 gal. spray can be made by diluting ⅓ pint of nicotine oleate, and is less than half the price of free nicotine spray used at the same strength. It is important that soft water, either rain or distilled, should be used for this spray. While nicotine oleate alone is more effective than the nicotine extracts now on the market, it can be made still more so by emulsifying an oil with it. These emulsions are not recommended when the trees are in leaf. They can be made by mixing 10 parts of an oil, such as cotton seed or kerosene, with 1¾ parts of red oil, to which is then added 2½ parts of 40 per cent. free nicotine solution. This should be shaken thoroughly, and 10 parts more of water should then be added and the mixture again shaken. For mealy bug [*Pseudococcus*], white fly [*Aleurodes*], etc., the solution should be diluted with soft water to make 500 parts.

General instructions for spraying with both dust and liquid sprays are given, with descriptions and illustrations of the requisite machinery and accessories. A spraying calendar for various fruit and vegetable crops is appended.

Graham (S. A.). **Some Insects Injurious to the Potato. Insects of the Home and Vegetable Garden. Insects Injurious to Small Fruits.**—*Minnesota Univ. Farm, St. Paul*, Circs. 47, 49, 50; 25th March, 15th April, 20th April 1918. 28 pp., 33 figs.

Potato pests of Minnesota include *Leptinotarsa decemlineata*, Say (Colorado potato beetle), of which there are two broods a year in this State. Natural enemies include Coccinellid beetles and the larvae of lace-wing flies, wild birds and domestic fowls; none of these however are a sufficient check, and an arsenical spray should be used as soon

as the eggs of the first generation begin to hatch, the treatment being repeated as often as necessary. *Epitrix cucumeris*, Harr. (potato flea beetle) has only recently appeared in Minnesota, but is found to do considerable damage in limited areas and will probably become an established pest. The larvae attack the roots and then burrow into the tuber; the adults feed on the under-side of the leaves. There is only one generation in a year. Bordeaux mixture has a repellent effect upon the beetle, but must be applied to the under-side of the leaves. *Empoasca mali*, Le B. (apple leaf-hopper) attacks many field crops, besides being an apple pest, and is particularly injurious to potatoes, upon which it appears in late June, ovipositing on the stems. It remains on the plants as long as they are green; there are two generations and perhaps a partial third. A contact spray, such as Nicofume, used in the strength of ½ U.S. pint 40 per cent. extract to 50 U.S. gals. water, with the addition of 2 lb. soft soap, should be used at the time when most of the hoppers are wingless, that is generally before the middle of July. *Macrosiphum solanifolii*, Ashm. (potato aphis) migrates to potato in late June or July, where it reproduces rapidly until the autumn migration. Natural enemies include Coccinellid beetles, Syrphid and lace-wing flies and various parasites. A contact spray should be used as for the leaf-hoppers, when the natural enemies are an insufficient check. Other potato insects include *Epicauta pennsylvanica*, De G. (blister beetle), various plant bugs, *Phytometra* (*Autographa*) *brassicae*, Riley (cabbage looper), stalk borers, cutworms, white grubs and wireworms. General rules for spraying potatoes are given.

Pests of vegetables include cutworms, white grubs, Aphids, *Leptinotarsa decemlineata* and *Diabrotica vittata*, F. (striped cucumber beetle), against which cucumber plants should be protected with cheesecloth covers until well developed, and the larvae killed at the roots with nicotine extract. *Pieris* (*Pontia*) *rapae*, Schr. (cabbage worm) should be checked with lead arsenate powder dusted on the plants. *Phorbia* (*Pegomyia*) *brassicae*, Bch., is a well-known pest of cabbage, cauliflower, radishes, turnips, etc.; tarred felt discs are required to protect the stems of the plants from it. A poison-bait made of ¾ oz. lead arsenate, ½ U.S. pint molasses and 1 U.S. gal. water, is used to kill the adults before they lay eggs. Peas and beans attacked by Bruchids should be heated in an oven to 180° F. before being stored in a dry place or in dry bins. General instructions for cultural methods and the use of insecticides are given.

Insects injurious to small fruits include *Pteronus ribesii*, Say (imported currant worm), of which there are two generations, one in early summer and the other about six weeks later. Poisons should be applied either in dust or liquid form. When the fruit is ripening, hellebore should be used; for liquid sprays 10 teaspoonsful of lead arsenate or 2 of Paris green should be used in 1 gal. of water. *Aegeria* (*Sesia*) *tipuliformis*, Clerck (currant borer) in the larval stage burrows in the stems of currant bushes, eventually killing them. All injured stems should be pruned and burnt before 1st June. *Myzus ribis*, L. (currant aphis), can be controlled by a contact spray of 1 or 2 tablespoonsful of Nicofume in a U.S. gal. of water, with a little soap. *Agrilus ruficollis*, F. (red-necked cane-borer) burrows spirally round raspberry canes, causing gall-like swellings and finally killing

the shoot. Infested canes should be cut out and burnt before 1st May. *Byturus unicolor*, Say, feeds on raspberry leaves, ovipositing on the flower-buds, and the larvae live on the developing fruit. As the larvae pupate in the ground, thorough cultivation will generally keep the insect in check. Paris green and lead arsenate have given fair success as stomach poisons, though neither is entirely satisfactory. In small areas, hand-collection of the adults is recommended. *Oecanthus nigricornis*, Wlk. (snowy tree cricket) injures raspberry canes and shoots of shrubs and trees by the punctures made in ovipositing. Injured canes or twigs should be pruned and burnt in winter or early spring. *Anthonomus signatus*, Say (strawberry weevil) greatly damages the June crop by cutting off the flower-buds after ovipositing in them. The most satisfactory control is rotation of crops. Only one or two crops should be taken from a bed and the new bed should be at some distance from the old one. Ploughing under the old beds is said to destroy most of the hibernating weevils. Burning over the beds after the crop is gathered also has some effect. *Zophodia grossulariae*, Pack. (gooseberry fruit-worm) has but one generation in a year; the larvae when full-grown drop to the ground to pupate. Thorough cultivation and the burning of rubbish will usually keep this pest in check.

WEISS (H. B.) & DICKERSON (E. L.). The Early Stages of *Corythucha pergandei*, Heid. (Hem., Hom.).—*Entom. News, Philadelphia*, xxix, no. 6, June 1918, pp. 205–209, 2 figs.

Corythuca pergandei is widely distributed in New Jersey, where it is found on alder (*Alnus glutinosa*) and birches (*Betula nigra*, *B. lutea* and *B. populifolia*). The adults hibernate under fallen leaves and in crevices of bark and appear in late May or early June, depositing eggs on the under-sides of leaves in the pubescent tissue in the axils formed by the main rib and its side branches. From 1 to 5 eggs were found in each axil, all being completely hidden. The nymphs after hatching feed in colonies on the under-sides of the leaves, causing discoloration. Adults of the first brood have developed by mid-July. From 5 to 6 weeks are required for a complete life-cycle and during the last days of August or early September adults of the second generation have developed and these hibernate. On account of the extended oviposition period, all nymphal stages are found feeding together. The egg and the various nymphal stages are described.

WILSON (H. F.). A New Species of *Macrosiphum* (Aphididae, Hom.).—*Entom. News, Philadelphia*, **xxix**, no. 6, June 1918, pp. 230–231, 1 fig.

Macrosiphum rhododendri, sp. n., is described, apterous, alate and pupal forms being taken in great numbers on leaves of *Rhododendron californicum* in the coast region of Oregon.

Emergency Entomological Service.—*Entom. News, Philadelphia*, xxix, no. 6, June 1918, pp. 234–236.

Various reports received by the United States Department of Agriculture are included in this heading. *Cylas formicarius* (sweet

potato weevil) has been found on an additional food-plant (*Calonyction bona-nox*) in Florida. Certain varieties of morning glory, especially *Ipomoea pes-caprae*, are considered to be preferred host-plants of this weevil and might serve as successful trap-crops. Losses in Texas from this insect have been particularly heavy. *Eleodes opaca* (false wireworm) has caused severe injury to wheat in Kansas. *Pyrausta nubilalis* Hb. (European corn-stalk borer) is very abundant on maize in Eastern Massachusetts, and is causing so much anxiety that it may be made a subject of quarantine.

CORY (E. N.). **Insects of 1916.**—*Maryland Expt. Sta., College Park,* n. d., 12 pp., 2 figs. [Received 25th June 1918.]

A brief and popular account is given of the following pests, taken from the year's records of over 60 injurious species in Maryland, and the usual methods of control for each are outlined: *Aphis pomi*, De G., *A. avenae*, F., *A. sorbi*, Kalt., *Cydia* (*Laspeyresia*) *molesta*, Busck, *Cydia* (*Carpocapsa*) *pomonella*, L., *Phyllotreta vittata*, F., *Pieris rapae*, L., *Phytometra* (*Plusia*) *brassicae*, Riley, *Haltica citri*, Ashm., *Typophorus canellus*, Lec. (strawberry leaf beetle), *Neocerata* (*Dasyneura*) *rhodophaga*, Coq. (rose midge), *Lopidea media*, Say (phlox plant bug), and *Cecidomyia catalpae*, Comst. (catalpa midge).

WOOD (W. B.) & SELKREGG (E. R.). **Further Notes on *Laspeyresia molesta*.**—Separate from *Jl. Agric. Research, Washington, D.C.*, xiii, no. 1, 1st April 1918, pp. 59–72, 10 plates. [Received 21st June 1918.]

Further investigations on the life-history, habits and control of *Cydia* (*Laspeyresia*) *molesta*, Busck (Oriental peach moth) have been made since the publication of a preliminary paper [see this *Review*, Ser. A, v, p. 75, also above, p. 369].

The food-plants of this pest, other than the peach, are cherry, plum, apricot, several varieties of flowering cherries, quince, pear, apple and flowering quince; of pomaceous fruits the quince is decidedly the favourite. It is possible that the insect travels from orchard to orchard by flight, since the moth is a strong flier at dusk and during cloudy days.

The character of injury and the amount of damage vary at different seasons of the year and on different food-plants, and though the damage caused by each of the early generations is separated from that due to the next by a distinct interval, later in the season the injury from each succeeding generation increases in severity without any such intervals.

The injury to twigs, which occurs mostly before midsummer, may not be noticed for several days after the newly hatched larvae have begun work, if the weather is cool and damp, but it becomes evident much sooner if the weather is hot. On peach it shows most plainly at midday or in the afternoon. Twig injury is most severe on the peach, quince, plum, apple, pear, nectarine and apricot, following in order.

The fruit of the peach is attacked by larvae of the second generation when it is about the size of a chestnut. The injury caused by their boring through it does not result in its rotting or fall. Mid-season

varieties of peaches and those ripening after 1st August are subject to severe injury, the larvae entering close to the stem and going direct to the seed.

Injury to pomaceous fruits, though it may not be severe in a commercial sense, is yet of economic importance, as the problem of control is complicated by the fact of a favoured food supply existing for the pest in the autumn after its normal host-fruits have disappeared.

Insects likely to be confused with *C. molesta*, either because of a close resemblance in the larval stage, or of a similarity in the injuries that they cause are:—*Cydia* (*Laspeyresia*) *pomonella*, L. (codling moth), *Enarmonia* (*L.*) *prunivora*, Walsh (lesser apple worm), *Anarsia lineatella*, Z. (peach twig borer) and *Enarmonia* (*L.*) *pyricolana*, Murtfeldt.

Eight species of Hymenopterous parasites of *C. molesta* have been reared, six being primary, and two secondary parasites. One Dipterous parasite, *Hypostena variabilis*, Coq., was also reared from larvae collected in the orchard. *Macrocentrus* sp. was the most abundant of the six primary Hymenopterous parasites, attacking the larvae of *C. molesta* and spinning its cocoon within that of the host. It is also a parasite of *C. pomonella*. Second in abundance was *Phaeogenes* sp., which probably attacks *C. molesta* in the prepupal or pupal stage. *Ascogaster carpocapsae*, Vier., oviposits in the egg of the host and kills the insect in the larval stage after it has spun its cocoon. Of the remaining parasites, *Spilocryptus* sp. attacks the larva after it has spun its cocoon, while *Mesostenus* sp. and *Glypta vulgaris*, Cress., attack the feeding larva and kill it before pupation. The two secondary parasites, *Dibrachys boucheanus*, Ratz., and *Cerambycobius* sp., were both found in cocoons of *Macrocentrus* sp.

Since the larva feeds within the twigs and fruit, it cannot be controlled on peaches by the use of poison-sprays. Lead arsenate, though applied just before the eggs were due to hatch, did not prevent the larvae from entering the twigs and fruit, and was quite ineffective. Negative results were also obtained with the same spray applied at other times, also with 40 per cent. nicotine sulphate solution diluted to 1 part in 400 parts water, and with a combination spray of lead arsenate and nicotine sulphate. Other attempted remedial measures were:—banding the trees with burlap; clipping and destroying infested twigs and fruit; immersing the cocoons containiug hibernating larvae in miscible oils and nicotine sulphate; and fumigating hibernating larvae with hydrocyanic-acid gas. But from the results obtained it appears impossible to free infested nursery stock from this insect by the last two methods, while the first two gave only negative results in the orchard.

Parasitism of the insect in the autumn undoubtedly is a factor in lessening the number of moths emerging in the spring, but the percentage of parasitism cannot yet be definitely stated.

War Vegetable Gardening and the Home Storage of Vegetables.—*National War Garden Commission, Maryland Building, Washington, D.C.*, 1918, 31 pp., 29 figs. [Received 21st June 1918.]

A section of this circular deals with disease and insect prevention, the usual fungicides and insecticides being recommended, and directions for their preparation being given.

SPEYER (E. R.). **Borers on Tapped Surfaces of Rubber**—*Trop. Agriculturist, Peradeniya,* l, no. 4, April 1918, p. 205. [Received 21st June 1918.]

At a meeting of the Committee of Agricultural Experiments held at Peradeniya in March, the author reported that in 55 per cent. of the recorded cases of Scolytid borers attacking rubber trees, the latter, or parts of them, had already been killed by fungi. There were no recorded cases of successful attack in healthy trees or healthy portions of trees. In recent reports of borers in tapped and untapped surfaces treated with tar and liquid fuel, it is probable that they had been attracted to small diseased patches and that in no case had the beetles been able to pass the latex layers. The remedy is to be found not in stopping the application of preservatives, but in removing at an early date the dead wood in which the beetles originate, and immediately destroying it by fire.

BERNARD (L.). **Cochylis et Eudémis. Capture des Papillons par les Pièges à Liquides.** [*Clysia ambiguella* and *Polychrosis botrana.* Capture of the Moths by Liquid Bait Traps.]—*La Vie Agric. et Rur., Paris,* viii, no. 24, 15th June 1918, pp. 407–409.

This paper is a résumé of previously published results of the experimental use of alcoholic liquid bait traps for vine moths. Against *Sparganothis pilleriana* and the summer generations of *Clysia ambiguella* and *Polychrosis botrana* these traps afford a simple, cheap and efficacious means of control, most useful in hot, dry seasons. They can never constitute a means of extinction, since their action is so limited against the spring generation, which it is most important to destroy; they form however a valuable secondary means of checking twilight-flying moths that are not affected by light traps.

DUPONT (P. R.). **Insect Notes. Curator's Report on Botanic Station, Seychelles, for 1917.**—MS. from Colonial Office, received 24th June 1918.

The following list is given of the insects attacking coconut in Seychelles: *Oryctes rhinoceros* (rhinoceros beetle); *Melitomma insulare*; *Diocalandra frumenti*; *Eugnoristus braueri*; *Ischnaspis longirostris* (*filiformis*); *Chrysomphalus aonidum* (*Aspidiotus ficus*), *Chrysomphalus* (*Aspidiotus*) *dictyospermi*; *Aspidiotus lataniae*; *Aspidiotus ansei*; *Chionaspis inday*; *C. dilatata*; *Icerya seychellarum*; *Vinsonia stellifera*; *Eucalymnatus* (*Lecanium*) *tessellatus*. *Oryctes rhinoceros* is doing damage owing to the refuse from the essential-oil distilleries forming new breeding places. The discovery in Madagascar by Mr. d'Emmerez de Charmoy of natural parasites of this beetle gives an opportunity for combating it by their introduction into Seychelles. These parasites are Scoliid wasps of which three species (*Triscolia hyalinata, Dielis collaris* var. *coelebs* and *Scolia pilosella*) already occur in Aldabra, a Seychelles dependency, N.W. of Madagascar. This means that the rhinoceros beetle parasite (*Scolia oryctophaga*) and other SCOLIIDAE would in all probability be easily acclimatised in Seychelles. *Melitomma insulare* is even worse than

the rhinoceros beetle in its ravages in coconut plantations. It is indigenous to the Seychelles and to Madagascar, and efforts should be made in Madagascar, where the insect fauna has not been disturbed on the same scale by bush fires as in Seychelles, to find its natural parasites. At present the larvae, which attack coconut stems only, are dug out and burnt. *Diocalandra frumenti* and *Eugnoristus braueri* damage the leaves of coconut. They have not spread to all plantations as yet, but the attacked leaves should be removed from the tree, on which they remain for a long time, and burnt. These weevils, the latter of which is endemic, are not considered to be dangerous pests. Scale-insects infest coconuts in Seychelles to a considerable extent. Fortunately most of them are likely to become parasitised by fungi when the weather conditions are suitable, but periods of drought such as that which occurred from 1904 to 1911 check the spread of these fungi. *Eucalymnatus tessellatus* is killed out by *Cephalosporium lecanii*, even in the low country. *Chionaspis inday*, which also attacks areca nut palms, was being destroyed in 1917 by some parasite, not yet identified. This scale is one of the oldest known enemies of coconut in the Colony. It attacks both the leaves and the husks. *Necrobia rufipes* is still doing damage to copra that has been stored for a long time, and *Silvanus surinamensis* to coconut cake.

Vanilla is rather free from insect attack, except by an aphis, *Cerataphis lataniae*, which is fostered by ants at the base of the flower-stalks. It is however never found in any numbers.

The leaves of Para rubber (*Hevea brasiliensis*) are attacked on a small scale by *Saissetia* (*Lecanium*) *nigra* and *Hemichionaspis aspidistrae*, but the former is kept in check by a fungus.

Limes, oranges, and other citrus trees are attacked by a number of scales, including:—*Coccus* (*Lecanium*) *viridis*; *Lepidosaphes beckii* (*Mytilaspis citricola*), which has been found to be kept under control by the red fungus, *Sphaerostilbe coccophila*; and *Chrysomphalus aonidum*, which is certainly parasitised, as it disappears from plantations as suddenly as it makes its appearance. Spraying with cheap fish-oil soap, made locally, is necessary to combat scale-insects.

Rose bushes are attacked at night by *Adoretus versutus* and in the day time by *Oxycetonia versicolor*. Both these beetles are very common, but could be destroyed by Scoliid parasites, if it is decided to introduce the latter from Madagascar.

Papaws (*Carica papaya*) are badly attacked by *Aulacaspis* (*Diaspis*) *pentagona*, a very common scale-insect in the Colony. Whitewashing the stem of the trees every 3 months gave excellent results as a measure against this pest at the Botanic Station.

Breadfruit (*Artocarpus incisa*) and jak fruit (*Artocarpus integrifolia*) are attacked by *Chrysomphalus aonidum* and *Icerya seychellarum*.

Custard apples (*Anona squamosa* and *A. reticulata*) and soursop (*Anona muricata*) are attacked by *Icerya seychellarum*, *Asterolecanium pustulans* var. *seychellarum*, and *Saissetia hemisphaerica*.

Coffee (*Coffea liberica*) is attacked by *Coccus viridis*, *Saissetia hemisphaerica* and *Ischnaspis longirostris*.

The oil palm (*Elaeis guineensis*) is also badly infested with the latter scale. Scorching the palms with kerosene blast torches combined with judicious pruning is being tried. It has been found impossible

to purchase blast torches, but coconut husks dipped in kerosene at the end of long poles are used instead.

Lantana (*Lantana camara*), a noxious weed which is spreading, is fortunately destroyed by *Pulvinaria antigoni* and *Asterolecanium pustulans.*

Mangos (*Mangifera indica*) are attacked by *Vinsonia stellifera*, *Coccus* (*Lecanium*) *mangiferae* and *Icerya seychellarum.*

Sugar-cane (*Saccharum officinarum*) is attacked by *Trochorrhopalus strangulatus*, a weevil that bores into the underground portion of the stem. The ravages of this insect are not considered important.

Bananas (*Musa paradisiaca*) are badly infested with *Cosmopolites sordidus*, which bores into the bulbous extremity of the pseudo-stem. Many species of plantain are immune. Stored maize is attacked by *Calandra oryzae*, and owing to the ravages of this weevil there is no grain left in the colony three months after the crop has been harvested.

Reports on the Agricultural Department, Tortola, 1915-16, and 1916-17, *Barbados*, 1918, 33 pp.

The yield of cotton was markedly diminished by the attacks of caterpillars and by a flower-bud maggot, *Contarinia gossypii*, which has not previously been recorded in the Virgin Islands.

Diaprepes abbreviatus (root borer of sugar-cane) or a closely allied species, caused considerable damage to the leaves of the bay tree, *Pimenta acris*. *D. abbreviatus doublieri* attacked the young parts of limes, bay, avocado pear and many ornamental plants.

A Longicorn beetle, *Batocera rubus*, has attacked papaws in Tortola. After destroying all the trees at the Experiment Station, the pest has spread considerably and is recorded from other localities throughout the island. Other trees attacked are *Ficus* sp., which is killed by it, the adults feeding on the leaves and young growing parts and the larva eating its way between the bark and wood. It is believed to spend nearly a year in the larval stage. *Spondias lutea* (hog plum) is also attacked, and probably avocado pear. This pest should be watched for in other islands, as its introduction would be serious in papaw-growing regions, and it would probably attack rubber-bearing trees, having already attacked a specimen of *Ficus elastica* growing in the Experiment Station. *Alabama argillacea* (cotton worm) was not plentiful, probably owing to lack of its food-plant, and *Dysdercus andreae* (cotton stainer) was less troublesome than in previous years.

Cotton (R. T.). **Experimental Work on the Control of the White Grubs of Porto Rico.**—*Jl. Dept. Agric. Porto Rico, Rio Piedras*, ii, no. 1, January 1918, pp. 1–18. [Received 24th June 1918.]

This paper is a brief report of the results of the vast amount of experimental work conducted in Porto Rico since 1908 with a view to discovering methods of controlling the white grubs [*Lachnosterna*] so destructive to sugar-cane in the island.

The entirely negative results show that hand-collection of the grubs and beetles is at present the only practical means of holding them in check, and it is far from being entirely satisfactory. The most promising method lies in the introduction of predaceous and parasitic enemies [see this *Review*, Ser. A, v, p. 410, 559].

STEVENSON (J. A.). **The Green Muscardine Fungus in Porto Rico.** (*Metarhizium anisopliae* **[Metsch.] Sorokin.**)—*Jl. Dept. Agric. Porto Rico, Rio Piedras*, ii, no. 1, January 1918, pp. 19–32, 3 figs. [Received 24th June 1918.]

Metarrhizium anisopliae (green muscardine fungus) was first noted and described in Russia, but attempts at its artificial dissemination have chiefly been made in the tropics and subtropics in connection with sugar-cane insects. It has been found occurring naturally in France, United States, Mexico, Trinidad, Samoa, Philippine Islands, Queensland. Java, Hawaii and Porto Rico, and has been introduced for trial under artificial conditions into Mauritius, Cuba and Argentina.

In 1911 it was introduced into Porto Rico from Hawaii on the supposition that it was not indigenous, but its subsequent discovery in localities far removed from the area of introduction points to its previous existence in the island.

The number of insects attacked is very large and includes many of considerable economic importance. The chief of these are:—*Adoretus compressus* in Java: *A. tenuimaculatus* and *A. umbrosus* in Hawaii; *Agriotes mancus* in New York; *Anisoplia austriaca* and *Bothynoderes* (*Cleonus*) *punctiventris* in Russia; *Cyrtacanthacris nigricornis* and *Holotrichia helleri* in Java; *Lachnosterna* sp. in Illinois; *Lepidiota albohirta* in Queensland; *Leucopholis rorida* in Java; *Oryctes rhinoceros* in Samoa; *Phytalus smithi* in Mauritius; *Rhabdocnemis obscurus* in Hawaii; *Tomaspis postica* in Mexico; and *T. saccharina* (*varia*) in Trinidad.

The insects found diseased by *Metarrhizium* in confinement in the breeding cages of Porto Rico are: *Aphodius* sp., *Canthon* sp., *Dyscinetus barbatus*, *Ligyrus tumulosus*, *Metamasius hemipterus*, *Lachnosterna* (*Phyllophaga*) *citri*, *L.* (*P.*) *guanicensis*, *L.* (*P.*) *portoricensis*, *L.* (*P.*) *vandinei*, *Phytalus insularis*, *Strategus titanus*, and *Tiphia inornata*, received from Illinois. The fungus has also been found on a number of undetermined Scarabaeids, an earwig, and a cockroach.

As a result of field observation and experiments the conclusion has been reached that *M. anisopliae* will not serve as a practical means of controlling the white grubs or May-beetles in the island. Although various stages of *Lachnosterna* spp. are subject to attack in confinement, no positive results have been obtained in the field tests, and it appears that the indigenous fungus is so dependent on humidity and other natural conditions that it is, and will remain, a negligible factor in controlling insect pests.

STEVENSON (J. A.) & COTTON (R. T.). **The Preparation and Use of Lime-Sulphur.**—*Porto Rico Insular Expt. Sta., Rio Piedras*, Circ. no. 13, 1918, 9 pp., 1 fig. [Received 27th June 1918.]

This circular gives full instructions for the making of lime-sulphur concentrate according to the formula:—Unslaked lime, 50 lb.; pure (99 per cent.) sulphur 100 lb.; water 50–60 U.S. gals. All the varieties of lime found in Porto Rico are suitable for the purpose, being free from magnesia, a high percentage of which is objectionable.

Sanders (J. G.). **A Handbook of Common Garden Pests.**—*Bull. Pennsylvania Dept. Agric., Harrisburg*, i, no. 2, May 1918, 24 pp., 20 figs.

This small handbook gives a very brief account of a few of the more important insect pests and diseases injurious in gardens, with recommendations for their control. Emphasis is laid on the importance of garden sanitation and autumn cultivation.

Cardin (P.). **La Mosca prieta y Medios para combatirla.** [*Aleurocanthus woglumi* and Means for combating it.]—*Republica de Cuba, Segretaria de Agricultura, Comercio y Trabajo, Comisión de Sanidad Vegetal, Havana*, Circ. no. 1, January 1917, 10 pp., 3 plates. [Received 12th June 1918.]

This circular contains a historical note on *Aleurocanthus woglumi*, Quaint., with a brief description of the adult and larva, also the text of a decree, dated 20th July 1916, requiring the instant notification of infestation and prohibiting the removal of various specified plants from infested areas or their importation from the East Indies, Jamaica and the Bahamas. The most suitable oil emulsion for this pest consists of kerosene 2 gals., hot water 1 gal., common yellow soap 9½–19 oz. This is a stock solution which must be diluted with 10 parts water.

Edrozo (L. B.). **A Study of Tobacco Worms and Methods of Control.**—*Philippine Agriculturist & Forester, Los Baños*, vi, no. 7, March 1918, pp. 195–209. [Received 22nd June 1918.]

Four species of Lepidopterous pests of tobacco in the field are dealt with in this paper, viz.:—*Prodenia litura*, F., *Heliothis* (*Chloridea*) *assulta*, Gn., *Phytometra* (*Plusia*) *eriosoma*, Gn., and *Phthorimaea* (*Gnorimoschema*) *heliopa*, Lower.

Of these, the Noctuid, *Prodenia litura* (tobacco cutworm), for many years recorded as *P. littoralis* and incorrectly identified in America as *P. ornithogalli*, Gn., occurs throughout the oriental and southern palaearctic regions and in the Philippines. Eggs are laid on both surfaces of the leaf, and the larvae begin eating along the midribs and proceed gradually to the margins, till none of the leaf blade remains. They have also been recorded as feeding on castor-oil plants, peanuts, lettuce and celery. Since the larvae pupate in the ground, tobacco should not be planted the year following an infested crop. The food-plants of this pest in the Philippines are:—tomato, tobacco, calaboa (*Monochoria hastata*), maize, cabbage, rice, sweet potato, castor (*Ricinus communis*) and jimson-weed (*Datura* sp.). In India its recorded food-plants are:—lucerne (*Medicago sativa*), jute (*Corchorus* spp.), indigo, potato, mulberry (*Morus alba*), *Ficus infectoria*, *Eleusine coracana*, ground nut (*Arachis hypogaea*), *Phaseolus radiatus*, *Cajanus indicus* and sugar-cane (*Saccharum officinarum*).

Heliothis assulta (tobacco false bud-worm) occurs during the entire growth period of the crop in the Philippines. The eggs are

laid singly on either surface of the leaf and the young larvae feed on the leaves, while the older larvae bore into the seed-pods. The life-cycle occupies on an average 36 days, there being thus a possibility of 10 broods in a year. *H. assulta* has a wide distribution and also occurs in West Africa, Asia, Japan, Queensland and Samoa.

Phthorimaea heliopa oviposits on tobacco on the surface of the stem, into which the newly-hatched larva penetrates and travels either upwards or downwards. When it has been inside for several days a swelling of the stem begins, followed by the wilting of the young buds. The best and most practical method of control is to pull up and destroy infested plants, if young; though vigorous plants can be dealt with by making a longitudinal cut on the swollen part of the stem with a clean, sharp, thin-bladed knife to expose and kill the larva. No further treatment of the plant is necessary. Seedlings, especially those that have been kept for a long time in seed-beds, are severely attacked, hence it is important to transplant them when about 6 inches high and to remove all shoots growing at the base of the plant and on the axils of the leaves. Spraying with Paris green does not prevent the moth from ovipositing on the stem.

Phytometra eriosoma, Gn., was first observed feeding on tobacco in 1914. While the plants were still in the seed-flats they were severely injured by larvae, very few of which, however, touched the plants after they had been transplanted and had reached the flowering stage. At this time the larvae occurred in large numbers on carrots, cress and celery.

The larva of *Acherontia lachesis*, F. (tobacco horn-worm), though not at present causing any serious injury to tobacco, is a potential pest that it is safer to destroy.

Prodenia litura and *Heliothis assulta* may be controlled by spraying with Paris green in either the wet or dry form, care being taken to cover both surfaces of the leaves. The Reduviid, *Euagoras plagiatus*, Burm., is predaceous on these two larvae, while *Phytometra eriosoma* is parasitised by a Braconid, *Urogaster* sp., and attacked by a fungus, *Cordyceps* sp. The caterpillars of all these species may be reduced by fowls, if a limited number are allowed the free run of the plantation, and also by handpicking.

La Cochenille australienne (*Icerya purchasi*) **et son Parasite naturel** (*Novius cardinalis*). [The Australian Scale Insect (*Icerya purchasi*) and its Natural Enemy (*Novius cardinalis*).]—*Bull. Soc. Etude Vulg. Zool. Agric., Bordeaux*, xvii, no. 6, June 1918, pp. 56–61.

A note under the above title was issued in March of this year by the Minister of Agriculture, drawing attention to the occurrence and life-history of *Icerya purchasi* (cottony cushion scale) and to the means of controlling it by its natural enemy, *Novius cardinalis*. Lest new centres of infection in southern France should become established and extended before the introduction of this Coccinellid, an insectarium has recently been established at Mentone, one department of which is specially devoted to the rearing of *Novius cardinalis* for rapid distribution [see this *Review*, Ser. A, v, p. 536].

Müller-Thurgau (H.). **Zur Bekämpfung des Heu- und Sauerwurms im Sommer.** [Notes on combating the first and second Generations of the Vine Moth, *Clysia ambiguella*, in Summer.]—*Schweiz. Zeitschr. Obst- u. Weinbau, Frauenfeld*, xxvii, no. 11, 3rd June 1918, pp. 165–170.

Recent remedial measures against *Clysia ambiguella*, Hbn.. are discussed. The use of arsenicals is deprecated in favour of nicotine sprays, which must be applied at high pressure, economy in fluid being effected by cutting off the jet when it is not actually aimed at the grape clusters. For the first generation spraying must be done about 10 days after the first large flight, and if the latter be prolonged owing to unfavourable weather, a second application must be made 8–10 days later. Spraying against the second generation should take place about 8 days after the chief flight. The solution should contain a minimum of 1·3 per thousand of nicotine, and though the addition of 1 per cent. soap may permit a less amount to be used, such a reduction is not advised. Bordeaux mixture may be used as a carrier instead of plain water.

Jegen (G.). **Die rote Spinne.** [Red Spider.]—*Schweiz. Zeitschr. Obst- u. Weinbau, Frauenfeld*, xxvii, no. 12, 15th June 1918, pp. 177–182, 1 fig.

Investigations at the Experiment Institute at Wädenswil have shown that soft-soap solution, soft-soap and nicotine, and a mixture of soft-soap and quassia solutions, are the best sprays against *Tetranychus*. The plain soft-soap solution at 4 per cent. strength is preferred and cannot damage the trees if applied before the buds open; a 3 per cent. solution is almost as efficacious. A spray containing equal parts of 1 per cent. soft-soap and 3 per cent. nicotine solutions kills all the eggs, while nearly all are destroyed by a mixture of equal parts of 1 per cent. soft soap and 2 per cent. quassia solutions.

Bedingungen für die staatliche Unterstützung der Versuche zur Bekämpfung des Heu- u. Sauerwurms. [Conditions of the State Grant in Aid of Experiments in checking the first and second Generations of *Clysia ambiguella*.]—*Schweiz. Zeitschr. Obst- u. Weinbau, Frauenfeld*, xxvii, no. 12, 15th June 1918, p. 184.

A State subvention of from 20 to 50 per cent. of the cost is granted by the Zürich Council for experiments with nicotine sprays and trap-lamps against the vine moth, *Clysia ambiguella*, Hbn. Whichever method is used, the area must be a large one, extending over the vineyards of several neighbouring growers and the number of lamps, etc., must be in accordance with the requirements of the local authority concerned. In the case of lamps the catches must be carefully counted and reported to the Experiment Institute at Wädenswil.

Lyle (G. T.). **Contributions to our Knowledge of the British Braconidae, no. 3, Microgasteridae.**—*Entomologist. London*, li, nos. 660–661, May-June 1918, pp. 104–111 & 129–137.

The species dealt with include:—*Diolcogaster marginatus*, Nees, the only bred specimen of which was obtained from a caterpillar of

Larentia viridaria; *D. calceatus*, Hal., common in the New Forest, where it has frequently been bred as a solitary parasite from caterpillars of *Thera variata* and *T. obliscata* in company with *Apanteles pinicola*; *D. circumvectus*, sp. n., a solitary parasite bred from larvae of *Lobophora carpinata* and hyperparasitised by *Astiphrommus plagiatus* and *Mesochorus confusus*; *Microgaster alvearius*, F., infesting Geometrid larvae, a brood of 79 having been obtained from a larva of *Hemerophila abruptaria*, as well as from *Boarmia gemmaria*, *B. repandata* and *Rumia luteolata*; *M. minutus*, a gregarious species, bred from *Cleora glabraria*; *M. connexus*, Nees, the commonest species in the genus, large broods being frequently obtained from larvae of *Arctornis chrysorrhoea* (*Porthesia similis*) and *Bombyx neustria*, hyperparasitised by *Pteromalus* sp. and *Pezomachus agilis*; *M. globatus*, a gregarious species, bred from *Vanessa atalanta*; *M. crassicornis*, Ruth., a common solitary parasite of the larvae of *Eupithecia denotata* (*campanulata*); *Microplitis ocellatae*, Bch., a common gregarious parasite of *Sphinx* (*Smerinthus*) *ocellatus* and *S. populi*: *M. vidua*, Ruth., the most important parasite of *Euclidia mi*, which hibernates in the larval state within its cocoon and is always a solitary parasite, the hyperparasite, *Mesochorus pectoralis*, having been reared from its cocoons; *M. ruricola*, sp. n., bred as a solitary parasite from half-grown larvae of *Anarta myrtilli*; *M. tristis*, Nees, a very common gregarious parasite of the larvae of *Dianthoecia capsincola* and *D. cucubali*, appearing in broods of from 12 to 20, and constructing cocoons beneath the surface of the ground; *M. sordipes*, Nees, a solitary parasite from half-grown larvae of *Acronycta alni* and *A. psi*; *M. spectabilis*, Hal., a brood of 22 being reared from a larva of *Dyschorista fissipuncta*; *M. mediator*, Hal., gregarious in broods of from 10 to 22, reared from Noctuid larvae that were probably attacked before hibernation and did not die until about a fortnight after the parasitic larvae had emerged; and *M. tuberculifera*, Wesm., one of the commonest English species, reared as a solitary parasite from young Noctuid larvae.

WALSH (G. B.). **Turnip-flea Beetles.**—*Entomologist, London*, li, no. 661, June 1918. pp. 141–142.

The larvae of *Phyllotreta undulata* are reported from Jarrow-on-Tyne as having occurred in the summer of 1917 in the leaf-stalks of turnips; these were hollowed for about half an inch, the roots remaining untouched. *P. nemorum* has a more restricted range in the north of Britain, being recorded as rare in the Hartlepool district and having been found by the author only once in six years in N. Yorkshire, where *P. undulata* is very common, the same being true of the Clyde district.

PANTANELLI (E.). **Experiments in the Disinfection of Dwarf Beans infested with** *Acanthoscelides obtectus* **and** *Spermophagus subfasciatus.*—*Mthly. Bull. Agric. Intell. & Pl. Dis., Rome*, ix, no. 5, May 1918, pp. 639–640. (Abstract from *Staz. sper. agrarie italiane, Modena*, l, no. 11–12, pp. 591–609.). [Received 9th July 1918.]

Dwarf beans arriving in Italy from Brazil were found to be infested with *Bruchus* (*Acanthoscelides*) *obtectus* and, much more seriously,

by *Spermophagus subfasciatus* (*musculus*), which is peculiar to South America and has only once been met with in Europe (Paris), where it did not increase. Experiments in the disinfection of seed and storehouses showed that fumigation of the seed with 50 gm. of carbon-bisulphide or about 50 cc. of carbon tetrachloride (=81·51 gm.) or 0·5 gm. of potassium cyanide, for 48 hours on each cwt. of dried beans, caused certain death to adult insects in the seeds. Germination of the seeds is more affected by the bisulphide than by the tetrachloride and is not affected at all by potassium cyanide. Storehouses can be satisfactorily disinfected by spraying with a tar-oil emulsion. Tests showed that at a temperature of 54° to 59° F. the adults of both species are destroyed by the use of certain proprietory brands of any of the following substances:—creoline, 7 parts; creselion, 6 parts; cresosol, 5 parts; or lysol, 4 parts, to 100 parts water.

The Campaign against the Codling Moth (*Carpocapsa pomonella*) **in Cyprus, in 1917.**—*Mthly. Bull. Agric. Intell. & Pl. Dis., Rome*, ix, no. 5, May 1918, p. 646. (Abstract from *Cyprus Agric. Jl., Nicosia*, xiii, no. 1, 1918, p. 13.) [Received 9th July 1918.]

By a Government Order of 25th April 1917, a campaign has been instituted in Cyprus against *Cydia* (*Carpocapsa*) *pomonella* (codling moth) infesting apple, pear, quince and walnut trees. The measures adopted are lime-dressing, daily collection and destruction of fallen fruit, and bandaging the trunks with grass or cloth bands. The grass bands, however, have not proved successful. Some 80,000 trees were lime-dressed.

D'Abreu (E. A.). **The Food of Birds in the Central Provinces.**—*Records Nagpur Museum, Nagpur*, no. 2, 1918. [Received 9th July 1918.]

This paper contains a record of the stomach contents of 600 birds shot in the Central Provinces, India, many of the insects found being of economic importance.

Dubois (P.). **La Protection des Cultures contre les Parasites d'Importation.** [The Protection of Crops against Imported Pests.]—*Vie Agricole et Rur., Paris*, viii, no. 27, 6th July 1918, pp. 17 & 18.

This paper reviews the subject of the importation of insect pests as it affects various countries, and urges the necessity for thorough fumigation of all horticultural consignments at the time of their exportation or importation.

de Seabra (A. F.) & Vayssière (P.). **Les Coccides de l'Ile de San Thomé (Hem.).** [The Coccids of the Island of San Thomé.]—*Bull. Soc. Entom. de France, Paris*, 1918, no. 10, 22nd May 1918, pp. 162–164.

Particulars are given of the Coccids found in the Island of San Thomé, which is one of the richest agricultural colonies of Portugal, with a view to precautions being taken against the introduction of any of these pests into French possessions in Africa.

The list includes *Icerya purchasi*, Mask., taken on a cultivated species of *Rosa*, not yet known in western or equatorial Africa; *Orthezia insignis*, Dougl., on *Coffea arabica*, being abundant on the leaves, attacking for preference the terminal shoot and probably encouraging the development of *Capnodium coffeae*; it has not yet been observed in French territory in Africa; *Pseudococcus citri*, Risso, taken on roots and fruits of *Theobroma cacao*; *Ceroplastes* sp., abundant on the branches of *Coffea arabica*; *Vinsonia stellifera*, Green, on leaves of *Citrus* sp., but not yet known to occur in Africa; *Saissetia* (*Lecanium*) *nigra*, Nietn., abundant on leaves of *Hevea guyanensis*, but apparently not very harmful; *Coccus* (*L.*) *viridis*, Green, on leaves of *Coffea liberica*, is a dangerous pest and should be watched, though fortunately, its most important natural enemy, the fungus *Cephalosporium lecanii*, also occurs in San Thomé; *Aulacaspis pentagona*, Targ., abundant on *Carica papaya* and on *Hevea guyanensis*, but not yet known to occur on the coast of the mainland; *Pseudaonidia trilobitiformis*, Green, taken on *Theobroma cacao*; *Aspidiotus palmae*, Morg. & Ckll., abundant on leaves of *Carica papaya* and *Artocarpus incisa* and less common on those of *Theobroma cacao*, *Persea gratissima* and *Citrus* sp.; *Selenaspidus articulatus*, Morg., on *Theobroma cacao* and other plants; *Morganella maskelli*, Ckll., on *Persea gratissima*, in company with *Aulacaspis pentagona*; *Lepidosaphes beckii*, Newm. (*citricola*, Pack.) on *Citrus* spp.; and *Ischnaspis filiformis*, Dougl., found rarely on leaves of *Coffea liberica*.

WELDON (G. P.). **Pear Growing in California.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, vii, no. 5, May 1918, pp. 371–407, figs. 165–186.

Among the numerous insect pests of pear trees dealt with in this bulletin are *Polycaon confertus* (branch and twig borer), which oviposits on the twigs of pear and other trees. The larvae bore into the twigs, frequently causing them to break. This pest is usually troublesome in the neighbourhood of brush piles, in which it hibernates and breeds; consequently brush piles and orchard prunings should be cleared up. *Aphis medicaginis* usually feeds on leguminous plants, such as sweet and bur clover, etc., but attacks pears when there is a scarcity of its usual food-plants, feeding upon the tender tips of the twigs. *Gymnonychus californicus* (California pear sawfly) in the larval stage eats circular-shaped holes in the leaves. *Eulecanium* (*Lecanium*) *cerasorum* (cherry or calico scale) is abundant in some localities, but does not generally require artificial control measures. *E.* (*L.*) *corni* is commonly found on pear trees, but its parasite, *Comys fusca*, generally serves to keep it in check. Borers include *Chrysobothris femorata* (flat-headed apple-tree borer), which frequently causes the death of injured or weakened trees; preventive measures include the protection of the trunks of young trees by whitewashing, or by tree protectors made of yucca or of heavy paper. *Xyleborus xylographus* (lesser shot-hole borer) bores small holes at the base of buds or into the heart of branches. All dead wood and prunings should be removed to prevent hibernation of this species and of *Scolytus* (*Eccoptogaster*) *rugulosus* (shot-hole borer or fruit-tree bark-beetle), which has similar

habits. *Epitrimerus pyri* (pear-leaf rust-mite) hibernates under the bud-scales and causes a dry, rusty appearance of the foliage. Sulphur sprays are recommended against it. *Schizura concinna* (red-humped caterpillar) causes defoliation of portions of the pear-tree. The larvae can often be found in the evening or early morning clustered on a twig, and the removal of this will perhaps destroy the whole colony. A lead arsenate spray should be used if necessary. *Palaeacrita vernata* (spring cankerworm) feeds on pear foliage; nicotine or lead arsenate sprays are recommended. *Eriocampoides limacina* (*Caliroa cerasi*) (pear slug) devours the upper surface of the leaves and may completely defoliate the tree. Eggs are laid just beneath the epidermis and the larvae begin their attacks in May. When full-grown they pupate in the soil and emerge for a second generation after midsummer. Trees sprayed early with lead arsenate are seldom attacked, but if the second generation appears, a nicotine or other contact spray should be used, making two applications at an interval of about a week. Dusting is also effective owing to the sliminess of the larvae, which causes the dust to adhere and finally results in death.

Under the heading of insecticides and fungicides, a list of contact and poison sprays, fumigants and repellents, is given, and many formulae for the control of the above-named and other pests of pear-trees are detailed. An ingenious chart is appended, showing at a glance those insecticides and fungicides that may be mixed with safety, as well as those that form dangerous or doubtful combinations.

BODKIN (G. E.). **Report of the Economic Biologist.**—*Brit. Guiana Dept. Sci. & Agric., Rept. for the Year 1916, Georgetown*, 10th May 1917, 14 pp. [Received 11th July 1918.]

On sugar-cane, the troublesome pest known as the giant moth borer [*Castnia licus*] is now well under control, occasional sporadic outbreaks being due to neglect in destruction of the insect. With regard to the two smaller moth borers [*Diatraea canella* and *D. saccharalis*], control measures are not undertaken with sufficient thoroughness and consequently the position is far from satisfactory. The main points in control are the careful selection of uninfested tops for planting, regular and thorough cutting out of infested parts from young canes, breeding and distribution of parasites in conjunction with a proper method of egg-collection, the supervision by a trained individual employed solely on this work, and the regular prosecution of all such work throughout the year

Rubber has chiefly suffered from the effects of the South American leaf disease; trees so attacked are frequently destroyed by termites, notably *Eutermes costaricensis*. An amended list of rubber pests includes the hawk moth, *Erinnyis elio*, L.; the Orthoptera, *Tropidacris collaris*, Stoll, and *Osmilia flavolineata*, DeG.; the ants, *Atta cephalotes*, L., and *A.* (*Acromyrmex*) *octospina*, Reich.; the bug, *Empicoris variolosus*, L.; the Coccids, *Asterolecanium* sp., *Vinsonia stellifera*, Westw., *Saissetia nigra*, Nietn., *Aspidiotus destructor*, Sign., and *A. personatus*, Comst.

Coconuts were severely damaged, as in former years, by the butterfly, *Brassolis sophorae*, L. It was observed that the caterpillars, instead

of pupating either in the disused nest or elsewhere in the crown of the tree, frequently descend the trunk of the palm and pupate in the empty husks and other débris lying about the base. The clearing up of all rubbish and empty husks on infested areas has consequently been made compulsory. This pest is apt to lie dormant for a time and then make a severe attack, palms being rapidly stripped of their foliage, and eventually the caterpillars, being unable to obtain food, scatter and pupate in the most convenient spots, thus rendering their destruction a difficult matter. These sudden infestations are undoubtedly regulated by the abundance of natural enemies, principally Hymenopterous parasites. The larvae of the Limacodid, *Sibine fusca*, Stoll, are increasing in numbers and on several occasions have been found to cause an infestation ascribed to *B. sophorae*. The large locust, *Tropidacris latreillei*, Perty, formerly a serious pest, has now almost completely disappeared. The larvae of the moth, *Castnia daedalus*, have continued their depredations in certain areas. In several cases the beetle, *Strategus aloeus*, L., was found to have descended to a considerable depth and destroyed the entire heart of a young palm.

Neither citrus plants nor rice are seriously infested by any insect; on the former scale-insects are the worst pest; on the latter *Laphygma frugiperda*, S. & A., still occurs, though not abundantly.

Cacao trees have been found infested with the following species of ants, their presence being frequently indicative of scale-insect infestation: *Daceton armigerum*, Ltr., *Cryptocerus atratus*, L., *Tetramorium guineense*, F., *Neoponera villosa inversa*, Sm., *Azteca instabilis*, Sm., and *A. velox*, Forel.

Investigations were carried out on the sugar-cane froghopper pest, *Tomaspis flavilatera*. Both this species and its parasites were studied, with the object of the possible introduction of the latter into the cane-fields of Trinidad. Froghoppers are not likely to become a serious pest in British Guiana. The following species have been identified: *Tomaspis flavilatera*, Urich, the nymphs of which feed on sugar-cane; *T. pubescens*, F., the nymphs feeding on grasses in the vicinity of cane-fields; *T. rubra*, Germ., abundant in the interior; and *Ischnorhina sanguinea*, F., a rare species from the interior.

Among destructive ants are *Atta* (*Acromyrmex*) *octospina*, Reich., which destroys the cambium layer of recently tapped rubber trees (*Hevea brasiliensis*); *Monomorium floricola*, Jerd., found infesting coconut palms and also in houses in all kinds of food, particularly oils, and devouring dead insects. *Tapinoma melanocephalum*, F., is perhaps the commonest species of ant in the Colony; it is found in every dwelling-house and building, attacking all kinds of food and also dead insects. *Camponotus* (*Myrmothrix*) *abdominalis stercorarius*, For., is common in cane-fields. *Azteca trigona subdentata*, For., is usually found accompanying Coccids. *Solenopsis pylades*, For., is the common red stinging ant of the coast-lands. It fosters *Pseudococcus sacchari*, Ckll. (sugar-cane mealy bug), *P. citri*, Risso, and *Saissetia nigra*, Nietn. It is occasionally destructive to rice by burrowing in the stem.

Attention has been given to the dragonflies of the coast-lands, some of which are of considerable economic importance, as they are predaceous on certain agricultural pests. A list of 22 species occurring

in the Colony is given. Among thrips, of which 12 species have been identified, *Frankliniella insularis*, Frankl., is found on blossoms of various plants, roses, etc.; *Heliothrips haemorrhoidalis*, Bch., is abundant on leaves of orange, avocado and other plants, frequently proving very destructive; *Hoplandothrips affinis*, Hood, has been taken from leaf-sheaths of sugar-cane; and *Franklinothrips vespiformis*, Cwfd., is a predaceous species.

A new Aleurodid, *Eudialeurodicus bodkini*, Q. & B., was found on leaves of *Erythrina glauca*.

Dodd (A. P.). **Records and Descriptions of Australian Chalcidoidea.**—*Trans. Proc. R. Soc. S. Australia, Adelaide*, xli, 24th December 1917, pp. 344-368. [Received 13th July 1918.]

Among the species recorded in this paper are:—*Stomatoceroides rubripes*, Gir., reared from Tineid larvae in eucalyptus galls; *Stomatoceras gracilicorpus*, Gir., a parasite of the sugar-cane bud-moth, *Opogona glycyphaga*, Meyrick; *Euryischia shakespearei*, Gir., reared from puparia of a small Dipteron attacking *Aphis sacchari* (sugar-cane aphis); *E. aleurodis*, sp. n., from *Aleurodes* on sugar-cane; *Polycystomyia benefica*, sp. n., *Trigonogastra agromyzae*, sp. n., and *Pterosema subaenea*, sp. n., all from *Agromyza phaseoli* (bean-fly) in stems of cow-pea; *Eurydinota braconis*, sp. n., bred from cocoons of *Apanteles* on larvae of *Cirphis* (*Leucania*) *unipuncta*; *Pterosemoidea drosophilae*, sp. n., bred from puparia of a Drosophilid fly, the larvae of which destroy *Pseudococcus calceolariae* (sugar-cane mealy bug); *Tetracnemella megymeni*, sp. n., bred from eggs of the bug *Megymenum insulare*; *Cristatithorax viridiscutum*, Gir., bred from the ootheca of a common Blattid, *Ellipsidion pellucidum*, on leaves of sugar-cane; *Anastatus aristotelea*, Gir., from eggs of the Neuropteron, *Torbia viridissima*; *Agamerion metallica*, Gir., a very common parasite in the oothecae of *Ellipsidion pellucidum*; *Neodimmockia agromyzae*, sp. n., from *Agromyza phaseoli* in stems of cow-pea; *Mestocharomyia oophaga*, sp. n., from oothecae of *Ellipsidion pellucidum*; *Pleurotropomyia aeneoscutellum*, Gir., bred from sugar-cane leaves infested with a leaf-mining Tineid, *Cosmopteryx* sp.; and *Rhicnopeltomyia aeneicoxa*, sp. n., reared from a pupa embedded in the midrib of a sugar-cane leaf.

Halligan (C. P.). **Strawberry Culture.**—*Michigan Agric. Expt. Sta., East Lansing*, Spec. Bull. no. 84, February 1918, 19 pp., 18 figs. [Received 13th July 1918.]

The pests of strawberries dealt with include white grubs [*Lachnosterna* spp.], which feed on the large roots or in the crowns, causing the wilting and dying of the plants. As the beetles producing these grubs oviposit in sod lands, such lands should be devoted to some other cultivated crop for at least one season before planting strawberries. Deep ploughing in the autumn will kill many of the grubs. The strawberry leaf-roller [*Ancylis comptana*] oviposits on the under-surface of the leaves in early spring, and the larvae fold over the leaflets and feed within them, causing them to die. Before

the leaves become rolled, two or three sprayings, at one week's interval, should be given to the plants, using 2 lb. lead arsenate to 50 U.S. gals. water. After the crop is gathered, the plants should be entirely cut down and burned.

WAID (C. W.). **Tomato Growing in Michigan.**—*Michigan Agric. Expt. Sta., East Lansing*, Spec. Bull. no. 89, March 1918, 18 pp. 9 figs. [Received 13th July 1918.]

The insects mentioned in this bulletin as pests of tomatoes are cutworms, for which poisoned bran mash is advocated, the potato beetle [*Leptinotarsa decemlineata*], blister beetles and flea-beetles, which can usually be killed by dusting with 1 part dry powdered lead arsenate diluted with 5 or 6 parts of flour, hydrated lime, air slaked lime or any other inert powder to serve as a carrier. This must be applied as soon as the larvae begin to appear. In planting out tomatoes in the field, care should be taken that there are no nymphs or immature forms of white-flies [*Aleurodes*] present on the plants.

PARROTT (P. J.) & GLASGOW (H.). **The Radish Maggot.**—*New York Agric. Expt. Sta., Geneva, N.Y.*, Bull. no. 442, November 1917, pp. 693–715, 8 plates, 2 figs. [Received 13th July 1918.]

In this bulletin, *Phorbia brassicae*, Bch. (radish or cabbage maggot) is dealt with in its relation to radish culture. The adult flies appear during early May; eggs are laid on the ground within 3 to 5 days: these hatch and the larvae begin their attacks on the roots of radish plants, the damage generally being most evident during June. In favourable conditions there are three broods and perhaps a partial fourth. Early sowing of the crop, so that it may be harvested before the period of danger from the maggots, is recommended, provided that favourable weather and soil conditions exist. For the protection of these early-sown radishes, frames covered with cheesecloth of 20 to 30 mesh have given excellent results, both protecting the plants from *Phorbia brassicae* and from flea-beetles (*Phyllotreta vittata*, F.), and producing finer plants than those grown in open beds.

ROBINSON (R. H.). **The Calcium Arsenates.**—*Oregon Agric. Coll. Expt. Sta., Corvallis*, Bull. 131, June 1918, 15 pp.

The information contained in this bulletin has previously been abstracted from another source [see this *Review*, Ser. A, vi, p. 338].

NEWCOMER (E. J.). **Some Stoneflies Injurious to Vegetation.**—*Jl. Agric. Research, Washington, D.C.*, xiii, no. 1, 1st April 1918, pp. 37–41, 3 plates. [Received 15th July 1918.]

Among the western species of stone-flies of the genus *Taeniopteryx*, including *T. pacifica*, Banks, *T. pallida*, Banks, and *T. nigripennis*, Banks, the first-named has proved to be of considerable economic importance. The first adults appear during March, when the fruit buds are beginning to swell, and as these begin to open, the flies eat large holes in them, frequently destroying them entirely. In other cases,

the ovary of the blossom is injured, resulting in deformed fruit. Later in the season, the insects feed on the calyx and corolla of the blossoms and on the young fruit and tender foliage. The favourite food-plants are apricot, peach and plum trees; trees with harder buds are much less liable to attack. The habit of feeding upon fruit trees is evidently an acquired one, as the early stages of the insect are passed in natural streams, and the species was undoubtedly abundant before fruit trees were ever planted in the valley. Upon examining the native vegetation, especially along the streams, the stone-fly was observed feeding to some extent on the leaves of wild rose, willows (*Salix* spp), wild cherry (*Prunus emarginata* and *P. demissa*), alder (*Alnus tenuifolia*) and elm (*Ulmus americana*). The shores of the Columbia River were examined and the flies were found emerging in large numbers, thousands of cast nymphal skins being strewn along the water's edge to 10 or 15 ft. above it. Evidently the adults fly to the trees as soon as their wings are dry, mate in the orchards and return to the river after feeding for oviposition in the water, where the eggs hatch. Whether the nymphs complete their development in a single year, or require two years or more, is not known.

While it has not as yet been possible to carry out extensive experiments in the control of *Taeniopteryx*, it was noticed in 1915 that plum-trees that had been sprayed with crude-oil emulsion and nicotine sulphate for Aphids were not so badly injured as untreated trees. Nicotine sulphate and soap also gave some measure of relief. It seems probable that complete protection against stone-flies could be effected by two applications of a spray composed of 2 lb. lead arsenate to 50 U.S. gals. water, the first as soon as the flies appear, the second either just before blossoming or just as the petals are falling.

Taeniopteryx nigripennis and *T. pallida* have been observed in pine woods at an elevation of 3,000 ft., feeding on native vegetation along the banks of a stream. The plants attacked were the thimbleberry (*Rubus parviflorus*), alder (*Alnus tenuifolia*), willow (*Salix* spp.), wild rose (*Rosa* sp.), service-berry (*Amelanchier* sp.) and maple (*Acer douglasi*).

It is probable that a study of the habits of stone-flies in other parts of the country, particularly of the genus *Taeniopteryx*, will reveal other plant-feeding and therefore potentially injurious species.

HORTON (J. R.). **The Argentine Ant in Relation to Citrus Groves.**—*U.S. Dept. Agric., Washington, D.C.*, Bull. no. 647, 3rd May 1918, 73 pp., 6 plates. [Received 15th July 1918.]

The subject matter of this bulletin has already been noticed [see this *Review*, Ser. A, vi, p. 313].

COOLEY (R. A.), PARKER (J. R.) & SEAMANS (H. L.). **Grasshopper Control in Montana.**—*Univ. Montana Agric. Expt. Sta., Bozeman*, Circ. no. 76, February 1918, pp. 119–147, 16 figs. [Received 15th July 1918.]

This circular deals at length with the control of grasshopper outbreaks by means of poisoned baits and catching machines. The latter can be used in low-growing crops, such as grain (before ripening), flax, potatoes, lucerne and grasses, and though the efficiency of the

two methods is probably about the same, the use of a catching machine results in the acquisition of a poultry food, the value of which more than covers the cost and operations of the machine.

FRENCH Junr. (C.). **Furniture and Timber Boring Insects.**—*Jl. Dept. Agric. Victoria, Melbourne*, xvi, no. 4, April 1918, pp. 214–221, 6 figs. [Received 15th July 1918.]

The chief timber-boring insect of Victoria is *Lyctus brunneus* (furniture and powder-post beetle), which oviposits on timber. The eggs hatch rapidly and the larvae at once bore into the wood, especially attacking the sap-wood.

Originally introduced into Australia in infected timber, tool-handles and wicker-work, it has made great headway during recent years, attacking furniture, especially the backs of book-cases, cupboards, the inside woodwork of pianos, table-legs and wicker-work. From this source it rapidly spreads to the roof and floor-timbers of houses, reducing them to sawdust and necessitating their renewal. Recent infestations in houses can be successfully dealt with by fumigation with hydrocyanic acid gas or carbon bisulphide.

All timber should be dried as soon as possible and should not remain closely packed in timber yards for any length of time; keeping it in the open air for about 18 months allows it to become thoroughly dried.

The House process of artificially seasoning timber by means of moist and dry heat, which occupies about a fortnight, does not damage it in any way, the colour being good and the fibres normal. Some timber merchants remove all the sap-wood; while timber intended for telegraph poles, flooring boards, mine props, etc., should be treated with one of the following:—corrosive sublimate, linseed or other preservative oils, kerosene, benzine, creosote, carbolic acid, benzine mixed with carbolic acid, carbolineum, white ant preservative or white ant exterminator. Floor joists, after they are laid, should be thoroughly dressed with oil to which has been added arsenic at the rate of 1 lb. to 1 gal.; this method has been used for years without harmful effects. The bark should be removed from trees as soon as they are felled and only the heart-wood should be utilised for timbering the concealed parts of buildings.

The pin-hole borer (*Anobium* sp.) oviposits on the wood into which the larvae bore; they do not remain in the sapwood as *L. brunneus* does, but penetrate into the very heart of the tree, the burrows often being several feet in length. This species has been found to attack red gum, mahogany, beech, oak, deal and red pine, the preventive and remedial measures recommended for the furniture borer being also applicable to it.

VAN ZWALUWENBURG (R. H.). **Report of the Entomologist.**—*Rept. Porto Rico Agric. Expt. Sta. for 1916, Mayaguez*, 5th February 1918, pp. 25–28. [Received 15th July 1918.]

Scapteriscus vicinus (Changa or mole-cricket) requires a year for the complete development of a generation, of which three weeks are passed in the egg-stage, nine months from hatching to the final moult, and two or three months in the stage preceding oviposition, which

occurs most commonly during the spring months. The night flights of adults are most marked during November and December, and it has been found that those captured at lights during October and November are more often females than males, and since at this time oviposition has not taken place, the use of trap-lights should constitute a valuable means of control. Further observations on this point of sex proportion are being made. The most satisfactory control measure in small areas is the persistent use of poisoned bait, but repellents have been found of little value. Flooding land for 24 hours or more may be practicable in some localities; by this means nymphs and adults are forced to the surface, where they fall a prey to insectivorous birds, while the eggs fail to hatch after submersion for a day or longer.

White-grub injury to sugar-cane was very frequent during the year, and especially severe on ratooned canes. The discontinuance of ratooning, though often desirable, is not practicable, as the smaller mills supplied by a small acreage of cane land cannot afford to lose the extra time required for a planted crop to mature. The large common species of *Lachnosterna* was captured in large numbers by means of a 400-candle power gasoline lamp, placed near the ground and operated as soon as the spring flight of the beetles began. Both sexes were taken in about equal numbers, and it was found that only 17 per cent. of the females had completed egg-laying.

Both the young and adult of *Amphiacusta caraibea*, a dark-brown cricket frequenting cool, moist locations, have been recorded as severely damaging various seedlings in the station plant-houses. This species, which has also been recorded as a household pest of foodstuffs, damages plants by burrowing beneath them and feeding from below, much in the same manner as the mole-cricket, injury by it being often attributed to the latter. The eggs, which are usually laid singly in the upper inch of soil, but which may be dropped promiscuously on the surface, hatch in about a month.

A serious outbreak of the yellow Aphid, *Sipha flava*, on young cane, severely retarding its growth, and in some cases causing its death, was eventually brought under control by natural enemies.

Sterictiphora zaddachi, the larvae of which feed on the leaves of *Coccoloba uvifera* (sea-grape) and *Chrysobalanus icaco*, is the only sawfly recorded from the W. Indies. The eggs are laid in clusters on the under-side of the leaf and the larvae are gregarious.

By far the most satisfactory spray yet found for the majority of Porto Rican insects is the paraffin-oil emulsion used by the U.S. Department of Agriculture in its work in Florida, since it is cheaper and less troublesome to prepare than home-made lime-sulphur.

The termite recorded in the previous report [see this *Review*, Ser. A, v. p. 227] under the name *Leucotermes* sp. as tunnelling in furniture and woodwork, has proved to be a species of *Cryptotermes*.

VAN ZWALUWENBURG (R. H.). **The Changa or West Indian Mole Cricket.**—*Porto Rico Agric. Expt. Sta., Mayaguez*, Bull. no. 23, 12th February 1918, 28 pp., 3 plates. [Received 15th July 1918.]

Much of the information contained in this bulletin has been previously noticed [see this *Review*, Ser. A, vi, p. 296]. *Scapteriscus*

vicinus is probably the most destructive agricultural pest in Porto Rico. Its natural enemies include a centipede (*Scolopendra alternans*), a tiger beetle, *Tetracha sobrina infuscata*, a Carabid, *Calosoma alternans*, and the larvae of an Elaterid beetle, *Pyrophorus luminosus*.

KINMAN (C. F.). **The Mango in Porto Rico.**—*Porto Rico Agric. Expt. Sta., Mayaguez*, Bull. no. 24, 4th February 1918, 30 pp., 11 plates. [Received 15th July 1918.]

The only insect pests of the mango which thus far have been of importance in Porto Rico are thrips and the fruit-fly, *Anastrepha fraterculus*. The latter is very injurious to the fruits of some varieties of both wild and imported mangos, and as it breeds in other wild fruits, some of which bear throughout the year, it would be very difficult to eradicate or control it. The cheapest and easiest way of preventing injury is by enclosing the fruit in cheap paper bags when it has attained its full size, but before it begins to ripen. It is advisable to make a small hole in the bottom of the bag to allow water to drain out that may enter by way of the fruit stem. Several hundreds of these bags can be attached by one person in a day, and though the covering to some extent hinders the development of the red blush on certain varieties, it protects the bloom and prevents sunburn, thus adding to the attractiveness of the fruit.

HUTSON (J. C.). **Some Insect Pests in Cuba.**—*Agric. News, Barbados*, xvii, no. 421, 15th June 1918, pp. 186–187.

A previous paper, dealing with the appearance, spread and control of *Aleurocanthus woglumi* (spiny citrus white-fly) in Cuba to the end of October 1916 has already been noticed [see this *Review*, Ser. A, v, p. 171]. Subsequent work on this pest has shown that, after hatching, the insect passes through three stages before becoming adult, during which time the damage due to it is done. A bad infestation causes the leaves to curl up, turn yellow, and eventually fall. The complete life-cycle occupies about sixty-five days, so that there may be five generations a year. Since the adult female lays on an average about 40 eggs, the pest is capable of a rapid increase in a comparatively short time.

The froghopper, *Monecphora bicincta*, became a pest of importance in Cuba in 1916, when it destroyed large areas of grass pasture consisting of Parana or Panama grass (*Panicum numidianum*) and Guinea grass (*P. maximum*), and also attacked *Sorghum halepense* and *Andropogon muricatus*. The damage is done mainly by the nymphs, which attack the base of the plant and the top of the roots, gradually sucking the plant dry. The eggs are laid on the soil close to the plant and hatch in from 12 to 20 days in the wet season, though under dry conditions they may remain unhatched for as long as 4 months. There are four moults, and under favourable conditions the complete development occupies from 32 to 40 days. Various control methods suggested, include :—the burning over of dried-up pasture areas, by which means the eggs and nymphs are destroyed, though a certain proportion of the adults will escape ; the collection of adults by means of trap-lights ; the use of a machine resembling a hopper-dozer, which,

however, is unsuitable for uneven ground; and lastly the use of green muscardine fungus [*Metarrhizium anisopliae*].

Pseudococcus sacchari (sugar-cane mealy-bug) attacks both the roots and stalk of the sugar-cane, sometimes killing the canes outright. This pest is considered to be the most serious insect problem in relation to sugar-cane in Cuba, the discovery of suitable remedial methods being a matter of urgent importance.

BOVELL (J. R.). **Report of the Department of Agriculture, Barbados, for 1916-1917.**—62 pp. [Received 15th July 1918.]

Experiments on the growing of sugar-cane with chemical fertilisers, and conducted on the same manurial plots for 24 consecutive years, were beginning to yield valuable results until four years ago, when the canes were so severely attacked by the larvae of *Diaprepes abbreviatus*, L. (root-borer) and *Phytalus smithi*, Arr. (brown hard-back) as to render the comparison of results impossible.

These two pests are increasing in Barbados in spite of the fact that in 1915 the 1,560 clumps in the plots were dug out, cut into pieces and the old cane-holes dug out 2 ft. square, 8,122 larvae being thus destroyed. The increase is due to the indifference of the vast majority of planters who still make no effort to combat the infestation. The loss due to these larvae in 1916–17 was at the rate of about £9 per acre, since 33 infested clumps had to be dug up before they were mature, and when the remaining clumps were reaped 8,227 larvae were dug out and destroyed, being an increase on the previous year.

The need for a united effort in collecting the larvae and mature insects, as well as in destroying the eggs, is emphasised by the fact that in Mauritius the pest is capable of destroying whole fields of cane, while in Porto Rico the larvae of certain allied hardbacks are on the increase and causing great loss to the sugar-cane growers.

Some proprietors are dealing with the pest by collecting the adult beetles, the hand picking of 589,680 of these having been paid for in one year on an estate of 500 acres. Others, again are substituting crops other than sugar-cane in the infested fields.

A preliminary list is given of the ticks, mites and insect pests of Barbados, exclusive of the COCCIDAE, which were recorded in the previous Report [see this *Review*, Ser. A, iv, p. 256], with remarks concerning their habits where known.

DASH (J. S.). **Report of the Assistant Superintendent of Agriculture on the Entomological and Mycological Work carried out during the Season under Review.** — *Rept. Dept. Agric. for 1916–17, Barbados*, 1917, pp. 56–60. [Received 15th July 1918.]

The attacks of *Diaprepes abbreviatus* (root-borer) and *Phytalus smithi* (brown hard-back) on sugar-cane seem to be increasing, and the losses due to them would have been far greater had it not been for the favourable growing weather that prevailed in 1916. *Diatraea saccharalis* (moth-borer) has continued to cause great annual loss owing to the lack of concerted action on the part of growers. Other minor pests of sugar-cane noted were:—the scale-insects,

Pseudococcus calceolariae, *P. sacchari*, and *Aspidiotus sacchari*, and the termites, *Coptotermes marabitanus*, Hag., and *Eutermes hatiensis*, Holmg., the latter being a local species.

Stenocranus (*Delphax*) *saccharivorus* (cane fly), a very serious pest in Jamaica, has not been observed in Barbados since 1914, when its eggs on cane leaves were heavily parasitised by the Mymarid, *Anagrus flavescens*.

Cotton was subject to small local attacks by *Eriophyes gossypii* (blister mite) and by *Alabama argillacea* and *Aletia luridula* (cotton caterpillars), which, however, were held in check with Paris green. Injury to the stem by *Porricondyla gossypii* (red maggot) was recorded from one locality during the year.

In several districts complaints were received of injury to sweet potatoes by *Euscepes batatae* (scarabee), the remedy for which lies in much improved methods of clean cultivation, such as planting from sound tubers only, and the removal and destruction of all infested material from the fields after harvesting.

Tetranychus telarius was present to some extent during the dry months. In cases where treatment was necessary dusting with flowers of sulphur and lime in about equal parts helped to control it.

Diaprepes abbreviatus was found severely attacking young potato plants grown as a rotation crop after infested cane. The stems below ground were bored so as to result in the death of the plants. Less susceptible plants, such as cotton or cassava, should be used in such cases as a rotation crop.

Peregrinus maidis, Ashm., was collected from sorghum leaves during the year.

Garden plants and citrus were found to be attacked by :—*Lepidosaphes beckii*, Newm., *Chionaspis citri*, Comst., *Pseudococcus citri*, Risso, and *Coccus viridis*, Green, the control of this last being attempted in one place by spraying with the fungus, *Cephalosporium lecanii*. A parasite of *Chrysomphalus dictyospermi*, Morg., was bred out and sent for identification. A species of *Diaspis*, probably *D. echinocacti*, was collected on cactus. A species of *Aspidiotus*, probably *A. rapax*, was collected on oleander. Two Cerambycids, *Achryson surinamum* and *Chlorida festiva*, were bred in large numbers from the trunk of an ebony tree. A thrips, probably *Thrips tabaci*, seriously infested eschalot leaves in one locality. The Ptinid, *Cathorama herbarium*, Gorh., was found eating into books and upholstered furniture. The Curculionids, *Promecops lunatus* and *Artipus corycaeus*, attacked bean leaves and the seed pods of *Abrus precatorius* respectively. The Scolytids, *Xyleborus confusus* and *Pycnarthrum pallidum*, were obtained, the latter from the bark of *Ficus nitida*.

Nezara viridula (green bug) has been reported as causing damage to tomato plants, laying eggs in clusters on the foliage and sucking the juices of the leaves and fruit. This pest can be controlled by hand-picking the eggs and adults. The larvae of *Prodenia dolichos* and *Pachyzancla bipunctalis* caused great injury to the foliage of certain ornamental plants. A species of termite infesting wooden buildings has been identified as *Rhinotermes nasutus*, Perty.

Species added to the collection of Barbados insects include the Tenebrionid, *Opatrinus gemellatus*, recorded as attacking young cotton plants in some of the other West Indian Islands.

MACOUN (W. T.). **The Potato in Canada, its Cultivation and Varieties.** —*Canada Dept. Agric. Div. Hortic., Ottawa*, Bull. no. 90 (Popular Ed.), 1918, 16 pp., 3 figs. [Received 16th July 1918.]

Damage to the leaves of potato plants by *Leptinotarsa decemlineata* (Colorado potato beetle) may be avoided by spraying immediately the larvae appear, which is in about a week after the eggs are laid. Where labour is cheap it is also advisable to handpick the adult beetles before oviposition.

The best poisons to use are Paris green and lead arsenate; either of these may be applied in both the wet and dry forms. Paris green should be used in the proportion of 8 oz. to 40 gals. water, at any time that the weather is fine. If it is to be used as a powder, the dusting should be done while the dew is on the foliage, the mixture consisting of 1 lb. Paris green to 50 lb. slaked lime, land plaster (gypsum) or any perfectly dry powder. Lead arsenate paste at the rate of 2 to 3 lb. to 40 gals. water, or powdered lead arsenate at the rate of 1 lb. to 1½ lb. adheres to the foliage better than Paris green, though it does not kill quite so rapidly. Hence a mixture is recommended consisting of 8 oz. Paris green and 1½ lb. lead arsenate paste to 40 gals. water.

The cucumber flea-beetle [*Epitrix cucumeris*] frequently causes great damage by making small holes in the leaves, thus inducing the attacks of potato fungus, but it may be controlled by spraying with Bordeaux mixture and lead arsenate.

DAVIS (J. J.) & TURNER (C. F.). **Popular and Practical Entomology, Experiments with Cutworm Baits.** —*Canadian Entomologist, London, Ont.*, l, no. 6, June 1918, pp. 187–192.

Owing to the ever-increasing price of bran, experiments have been undertaken in Indiana to test the suitability of sawdust as a substitute for it in poison-baits. The regulation bran mash composed of 1 lb. poison to 25 lb. filler (bran or sawdust), with 2 quarts molasses, 6 lemons and water as needed, was made up according to 3 formulae, containing respectively Paris green and bran, Paris green and sawdust, and white arsenic and bran, and these mixtures were used in a field badly infested with *Agrotis ypsilon* (greasy cutworm). The ground was treated on 9th July, maize was replanted on 14th July, and counts made on 23rd July showed that sawdust gave distinctly good results, though not so good as those with bran. When used at the rate of 5 lb. to the acre, the figures were:—Paris green and bran, 2 per cent. plants attacked; white arsenic and bran, 3 per cent. plants attacked; Paris green and sawdust, 5 per cent. plants attacked; control plot, 50 per cent. plants attacked.

Similar experiments were conducted for the control of *Cirphis unipuncta* (army worm). The poisons were used in the proportion of 1 lb. to 25 lb. filler and 1 lb. to 50 lb. filler, the bait being scattered at the rate of 10 lb. per acre. Examinations made two days later showed about 75 per cent. dead in the sawdust-bait area and practically all dead in the area treated with bran. Similar laboratory experiments confirmed the view that sawdust has some value, and can be recommended when it is impossible or very difficult to obtain bran; but when it is used, a second application will probably be necessary,

and the admixture of some bran to prevent the bait from drying and scattering too quickly is desirable.

As regards the kind of sawdust used, it was found that pine sawdust has a decidedly repellent effect, while that of old hardwood (oak and hickory) was not so attractive as that of new hickory, which was used in these experiments.

Further experiments were made to test the effectiveness of Paris green, calcium arsenate, sodium arsenite, lead arsenate, arsenious acid (white arsenic) and crude arsenious acid (a by-product of copper refineries containing 88 per cent. of arsenious acid). When this last was used at a strength of 1 to 40, it had a killing power nearly equal to that of Paris green at the same strength, and even as weak as 1–60 the results were very satisfactory, while at the rate of 1–25 it was remarkably effective. In short, Paris green, crude arsenious oxide and sodium arsenite are the most desirable for poison-baits, calcium arsenate being next in value. Lead arsenate should be used only when the above-mentioned are not available, since its action is much slower, even at twice the strength, though at the end of five or six days it is more effective than any of the other poisons. The results with white arsenic were wholly negative.

Baits prepared with lemon extract in place of lemon fruit and with or without molasses, showed that the presence or absence of the latter made little difference, while lemon extract gave a higher percentage of effectiveness than the fruit, an important result in view of the greater convenience often attending its use. The results of experiments with banana in place of citrus fruits were very satisfactory, and warrant further trials in the field.

WEISS (H. B.) & DICKERSON (E. L.). **The Early Stages of *Empoasca trifasciata*, Gill.**—*Canadian Entomologist, London, Ont.*, l, no. 6, June 1918, pp. 201–205.

The small leaf-hopper, *Empoasca trifasciata*, is fairly well distributed in New Jersey, being found on *Populus deltoides* (Carolina poplar) and *P. nigra italica* (Lombardy poplar), especially the former. Hibernation takes place in the egg-stage, the eggs being deposited in the young twigs and hatching in the latter part of May or early in June. The nymphal stages occupy three to four weeks, adults of the first brood being present by the end of June or beginning of July. The summer eggs then deposited hatch during the last week of July, adults of the second brood being present by the end of August. The winter eggs are deposited during September, the adults surviving till the cool weather of early October. The extremely active adults scatter soon after emergence, but on rainy days have a tendency to collect on the foliage, especially on the under-surface, where their feeding produces a whitish discoloration of the upper surface.

GARNETT (R. T.). **An Annotated List of the Cerambycidae of California.**—*Canadian Entomologist, London, Ont.*, l, no. 6, June 1918, pp. 205–213.

This further instalment of a list of Californian Cerambycids [see this *Review*, Ser. A, vi, p. 363] includes among other species of economic importance :—*Hybodera tuberculata*, Lec., breeding in maple ;

Megobrium edwardsi, Lec., found on oak and live oak; *Holopleura helena*, Lec. (*marginata*, Lec.) bred from laurel; *Rosalia funebris*, Mots., breeding in laurel and ash; *Tragidion annulatum*, Lec., found on mesquite; *Cyllene antennatus*, White, breeding in mesquite; *Clytus planifrons*, Lec., bred from dead branches of willow; *Xylotrechus undulatus*, Say, breeding in *Pseudotsuga taxifolia* and probably other coniferous trees including *Pinus ponderosa*; *X. insignis* Lec. (*obliteratus*, Lec.), breeding in various species of willow; *X. annosus*, Say, breeding in poplar; *Neoclytus conjunctus*, Lec., breeding in *Quercus douglasi* and *Fraxinus oregona*; *Atimia dorsalis*, Lec., breeding in post cedar; *Desmocerus auripennis*, Chevr., *D. cribripennis*, Horn, and *D. californicus*, Horn, breeding in elderberry; *Necydalis laevicollis*, Lec., bred from tan-bark oak; *Pyrotrichus vitticollis*, Lec., breeding in the heart-wood of alders; *Leptalia macilenta*, Mann., breeding in willow; *Rhagium lineatum*, Oliv., breeding in various pines; *Centrodera nevadica*, Lec., breeding in *Pinus ponderosa*; *Pachyta liturata*, Kirby, breeding in fir; and *P. spurca*, Lec., breeding in *Pseudotsuga taxifolia*.

CHAPAIS (J. C.). **Notes concernant L'"Hemerocampa marquée de Blanc."** [Notes on the White-marked Tussock Moth.]—*Nat. Canad., Quebec*, xliv, no. 11, May 1918, pp. 163–166, 4 figs. [Received 18th July 1918.]

In 1917, the orchards of eastern parts of the province of Quebec were severely damaged with the white-marked tussock moth [*Hemerocampa leucostigma*]. The remedial measures recommended are the collection of the cocoons and the spraying of larvae hatching in May and June. All the cocoons collected should be kept till the following spring in boxes covered with metallic gauze, to preserve any parasites with which they may have been infested.

MOORE (W.) & GRAHAM (S. A.). **Physical Properties governing the Efficacy of Contact Insecticides.**—*Jl. Agric. Research, Washington, D.C.*, xiii, no. 11, 10th June 1918, pp. 523–538.

Formerly it was considered that contact insecticides killed the insects to which they were applied by means of their vapour and that their volatility was the index of their toxicity when used as sprays. In working with insect eggs, however, it was found that materials not volatile enough to kill insects or their eggs by their vapour within a reasonable length of time were among the most effective materials when applied to eggs as liquids.

This action is due to the physical properties of wetting and spreading, terms that are not strictly synonymous, wetting being the adhesion between the liquid and the solid, while spreading is the excess of the adhesion between the liquid and solid over the cohesion of the liquid. If the cohesion of a liquid is less than the adhesion between the chitin forming the outer covering of the insect and the spray, then the liquid will spread, the rate at which this takes place being governed by the viscosity of the liquid. If the cohesion of the liquid is greater

than this adhesion, the spray will form into droplets, which tend to roll off, the same result being obtained when the spray does not wet the insect. The same properties determine the degree of penetration of a liquid into the tracheae by capillarity.

Hence contact insecticides may be divided into two groups:—(1) those that wet, but which do not spread, owing to their adhesion being less than their cohesion; and (2) those that wet and spread over the surface and are able to gain entrance to the tracheae by capillarity, since their cohesion is less than their adhesion.

Experiments seem to indicate that the composition of chitin is such that it is easily wetted by oil and oil solvents, or its surface may be coated with an oily or fatty substance, and therefore contact insecticides which are either soluble in ether or chloroform, or are fat solvents, are able to spread over the insect and enter the tracheae. It has also been shown that compounds with a viscosity as high as, or higher than castor oil, spread so slowly that they may be classed as poor insecticides; while compounds more volatile than xylene evaporate too quickly for effective work.

In the case of emulsions, the power to penetrate the tracheae depends on the character of the emulsifier and not on the emulsified oil. Those made with gelatin or saponin tend to form droplets and roll off; those made with Castile or soft soap adhere, spread and penetrate the tracheae, carrying the emulsified oil with them; but those made with ivory soap, though they adhere, are too viscous to spread rapidly and ultimately break down, though the oil remaining may spread over the insect and enter the spiracles. The watery part of such emulsions evaporates in from 5 to 30 minutes, the length of time depending on the temperature and humidity of the atmosphere, the time however being sufficient for a volatile oil to evaporate before reaching the tracheae.

Experimental evidence shows that solutions of soaps containing a large proportion of alkali are more toxic than those which are practically neutral. It also proves that the vapour of volatile oils and acids can penetrate the walls of the tracheae more rapidly than the liquid. On the other hand, aqueous solutions such as nicotine do not penetrate the tracheae at all except in the form of vapour. When nicotine sulphate comes in contact with the body of an insect, it is slowly decomposed, with the formation of nicotine which enters as a vapour. Such a decomposition doubtless explains the fact that leaves sprayed with nicotine sulphate, even when dry, are repellent and poisonous to insect larvae, even though not taken internally.

In the case of very volatile compounds, there is a tendency to re-evaporation from the tracheal walls, hence the atmosphere must be saturated, and consequently a much larger amount of such a compound is required to kill an insect than of a slightly volatile compound, and thus volatility comes to be an index of the ability of a compound to gain entrance into the insect, and is therefore closely correlated with toxicity.

A notable exception to this is the compound chloropicrin, which penetrates the walls of the tracheae and kills very quickly, its action being due, either to its extreme toxicity, or to an abnormal power of penetration.

MILLIKEN (F. B.). *Nysius ericae*, **the False Chinch Bug.**—*Jl. Agric. Research, Washington, D.C.*, xiii, no. 11, 10th June 1918, pp. 571–578, 2 plates.

Nysius ericae, Schilling (*angustatus*, Uhler) (false chinch bug) has been for many years a serious pest in the semi-arid regions of the United States, causing great damage to sugar-beet and cruciferous garden crops, by settling upon them suddenly in enormous numbers and sucking so much sap from them that the plants wilt beyond recovery in a day or two.

The eggs are deposited in loose soil, among clods or rubbish; in composite flowers, such as those of *Gaillardia pulchella*; between the glumes in grasses, such as *Eragrostis major*; among the clustered parts of plants, such as thyme-leaved spurge (*Chamaesyce serpyllifolia*) and carpet-weed (*Mollugo verticillata*); among the down of cottonwood trees (*Populus* spp.) and in similar places.

With an average temperature of about 80° F., the eggs hatch in about 4 days. The nymphal period, during which there are normally 5 moults, has an average length of about 20 days, a greater or less number of moults, however, being not only possible, but probable. Newly matured females have never been observed to mate in less than three days, oviposition occurring one day later.

The seasonal reproductive activity of this species is greatest during May and June, and again during September and October. The minimum number of generations in an average season beginning about 1st June is five, and since the species hibernates in the egg-stage, or as a young nymph which completes its development very early the next spring, to these must be added the overwintering generation and a possible generation in the spring, making seven in all.

BURRILL (A. C.). **Losses caused by the Clover Aphis.**—*Univ. Idaho Agric. Expt. Sta., Moscow, Id.*, Bull. no. 104, January 1918, pp. 26–29. [Received 22nd July 1918.]

This paper, which is included in the annual report for the year 1917, contains an account of *Aphis bakeri*, Cowen (clover aphis). This pest causes a loss of as much as 75 per cent. of a normal crop by sucking the sap and thus reducing the yield of seed. Later in the season the great accumulations of honey dew produced by it clogs the threshing machines and causes the seed to solidify like cement in the sacks, resulting in great trouble and expense in harvesting and marketing.

The winged form of this Aphid is supposed to migrate from fruit trees to clover in the spring, and back again to fruit trees in the autumn. The fact that it is found on clover so early in spring as to preclude the possibility of its having migrated thither from fruit trees led to the belief that it also oviposited on clover. This early appearance is however explained by the fact that winged forms are produced continuously through the summer and autumn and even into midwinter, having occurred in January 1918 when snow was on the ground. This fact negatives any plan of control by crop rotation, cultivation or irrigation, or by the use of a dormant spray on fruit trees to prevent

the spring migration to clover. Eggs are laid abundantly on Anjou pear, Hungarian prune and quince, but the insect apparently shows no preference for apple leaves.

The method of control by means of the Coccinellid, *Hippodamia convergens*, Guér., has been tried experimentally, and if it should prove successful, would be far cheaper than the use of sprays.

The pasturing of a few head of stock continuously in clover stubble during the summer does not completely destroy the Aphid, but a flock of 1,000 sheep pastured for a full week in December on a 60-acre field, partly in grain and partly in clover, resulted in its complete extermination in that field. The problem of seed production cannot, however, be settled by this means, since a new infestation may arise in the summer within 6 or 8 weeks, the time usually required for the production of a crop of red clover seed.

EDMUNDSON (W. C.). **Sprays for the Control of San José Scale.**—*Univ. Idaho Agric. Expt. Sta. Dept. Hortic., Moscow, Id.*, Bull. no. 108, February 1918, 16 pp., 7 figs. [Received 22nd July 1918.]

This bulletin gives a detailed account of experiments in combating *Aspidiotus perniciosus* by spraying with the sulphur sprays:—Lime-sulphur, soluble sulphur, Spra sulphur, and dry lime-sulphur; and the oil sprays: Scalecide, crude oil emulsion from virgin crude oil, crude oil emulsion from oil testing 26° Baumé, and dormant soluble oil.

The results obtained by the use of lime-sulphur were very satisfactory, and its use is to be recommended in preference to that of soluble sulphur. Dormant soluble oil also gave very good results, but the best of all were obtained by the use of scalecide, which could be relied on to clear a badly infested orchard, since it destroyed 99 per cent. of the scales, although its cost is almost prohibitive.

FULLAWAY (D.). **Division of Entomology.**—*Hawaiian Forester & Agriculturist, Honolulu*, xv, no. 4, April 1918, pp. 90-91. [Received 25th July 1918.]

During the month of March the insectary handled 25,500 pupae of the melon fly [*Dacus cucurbitae*], from which were bred 1,467 individuals of *Opius fletcheri*. The distribution of parasites was as follows: *O. fletcheri*, 1,502; *Diachasma fullawayi*, 123; *D. tryoni*, 190; *Opius humilis*, 75; *Tetrastichus giffardianus*, 80; *Galesus silvestrii*, 700; *Dirhinus giffardi*, 200; and *Paranagrus osborni*, 30,200.

TRABUT (Dr.). **L'Arboriculture fruitière dans le Nord de l'Afrique: Maladies et Ennemis du Prunier.** [Fruit Tree Cultivation in Northern Africa: Diseases and Enemies of Plum Trees.]—*Bull. Agric. Algér. Tun. Maroc., Algiers*, xxiv, no. 5, May 1918, p. 89.

A Buprestid, *Capnodis* sp., in some localities of northern Africa, particularly on the coast, is a serious obstacle to the cultivation of plum trees. As soon as the beetles appear on the trees, they should be picked off. In order to prevent oviposition, which occurs in May and June in crevices of the bark at the base of the tree and on the

larger roots, a wash should be applied. This is prepared by dissolving 10 lb. copper sulphate in 6 gals. water. Another 6 gals. water is poured on to 20 lb. lime, and when this has cooled, the two are combined, and to the mixture is added $\frac{1}{2}$ lb. sodium arsenate or $1\frac{1}{2}$ lb. lead arsenate.

Kankitsu gaichu Rubii-Romushi. [The Ruby Wax-scale, an Insect injurious to Citrus.]—*Shizuoka Agric. Expt. Sta.*, 28th February 1918, 17 pp., 2 plates. [Received 7th August 1918.]

Ceroplastes rubens, Mask., is a formidable pest of citrus plants in Japan, as also are *Chionaspis citri*, Comst., and *Icerya purchasi*, Mask. It was first recorded in 1885 in the Prefecture of Nagasaki and was afterwards imported into the Prefecture of Shizuoka in 1907 on citrus seedlings, and is now infesting several districts. This scale has only one brood. The over-wintered female begins to oviposit at the end of June and continues to do so until the end of July. The male appears at the beginning or the middle of September, when pairing takes place, only the female surviving the winter. The average number of eggs laid is 978. In starvation experiments, 74 per cent. of the insects survived for over two months. This scale is not only harmful in itself, but often gives rise to a sooty fungus on the trees.

As regards preventive measures, fumigation in winter with hydrocyanic gas, using 200 grammes of potassium cyanide for over 45 minutes, is most effective; kerosene or resin emulsions are not satisfactory at this time. In summer, however, resin emulsion, if applied at least twice, first in the middle of July and secondly at the beginning or the middle of August, may be very effective. When new infestations are discovered, the scales should be crushed and the infested portions of the plants removed at the first opportunity. When citrus seedlings are purchased, they should carefully be examined and fumigated.

OJIMA (G). **Meichu Rankiseiho Hogoyo no Ekichu Hogoki.** [An Apparatus for the Preservation of Hymenopterous Egg-Parasites of the Rice-plant Borer.]—*Byochugai Zashi* [*Journal of Plant Protection*], *Tokyo*, v, no. 3, March 1918, pp. 10–11, 2 figs.

The apparatus here described consists of an inverted cone, about 1 foot high and 3 inches in diameter at the top. When in use, the pointed end is buried in the soil. The cone is made of zinc and is closed at the top with a hinged lid, which is provided with a handle. Between the lid and the edge of the cone is a narrow slit on one side to permit the exit of the parasites. Inside the cone and $1\frac{1}{2}$ inches from the top is a small trough containing petroleum, which prevents the exit of the caterpillars of the host that may have escaped parasitism. About $1\frac{1}{2}$ inches from the bottom of the cone is a wire septum on which the egg-clusters lie.

These cones are distributed throughout the rice fields and parasitised egg-clusters are put into them, each containing about 400 individuals. Any borers that hatch from them are caught in the petroleum, while the parasites escape through the slit already mentioned, and infest other egg-clusters in the field.

Maki (S.) & **Rin** (G.). **Takenoko no gaichu ni tsuite.** [On the injurious Insects of Bamboo Shoots.]—*Ringyo Shikenyo Hokoku* [*Report from the Forest Experiment Station*], *Formosan Government Industry Bureau, Taipe*, Publication 104, no. 5, 28th March 1918, pp. 85–100, 3 plates.

Bamboo shoots are widely used for food in Japan. In Formosa, out of 21 species of bamboo belonging to 4 genera, *Bambusa oldhami*, *Dendrocalamus latiflorus*, *Phyllostachys makinoi*, and *P. mitis* are known to be edible. In that island bamboo shoots are grown very largely; for example, a bamboo guild of the Nanto Prefecture [in one year ?] dealt in about 840 tons of bamboo-shoots of a value of about £15,000.

The authors have studied the insect pests of these edible bamboos and have discovered three species.

The weevil, *Cyrtotrachelus longipes*, F., infests bamboos from April to September or October. It makes a longitudinal slit on the shoots with its rostrum from one to four inches below the apex, in which it deposits one or rarely two eggs. The eggs hatch out in 4 or 5 days, and the larvae devour the stem. Pupation takes place in the soil. The natives use the adult weevil for food, and it is often used in medicine. As no satisfactory preventive measure is as yet known, this utilisation of the weevil for food should be encouraged for the present.

The Trypetid fly, *Acroceratitis plumosa*, Hendel, is an endemic species in Formosa and is a very formidable pest. The adult fly occurs throughout the island during the whole year. It deposits a number of eggs in the young shoots under the sheath. The eggs hatch out shortly afterwards and the maggots penetrate into the stem, boring in several directions and causing the shoot to decay. The mature larvae enter the soil and pupate. As regards preventive measures, bamboo-shoots should be covered with fallen leaves, etc., so as to prevent the oviposition of the adult flies. The infested shoots should be fumigated with carbon bisulphide, which may kill both larvae and pupae, if fumigation is carried out for over 12 hours, but no really effective measures are known.

The Coreid bug, *Notobitus meleagris*, F., about which little is known, lays 10 to 20 or more eggs in rows on the sheath of the bamboo-shoot. The newly hatched young suck the stem of the shoots. The only remedial measure suggested is the removal of the eggs.

Yano (M.) & **Koyama** (M.). **Shinyo ju Shushi Kiseibo ni tsuite.** [On Wasps parasitising the Seeds of Coniferous Trees.]—*Ringyo Shiken Hokoku* [*Report of Forest Experiments*], *Forestry Bureau, Tokyo*, no. 17, 30th March 1918, pp. 38–58, 1 plate.

The fact that certain Hymenoptera belonging to the Chalcididae infest the seeds of coniferous trees, such as *Cryptomeria japonica*, *Chamaecyparis obtusa*, *Thujopsis dolabrata*, *Larix leptolepis*, *Tsuga sieboldi*, etc., was recorded in Japan as long ago as 1905, though they were not then specifically determined.

The Chalcididae, other than the Agaoninae and Isosominae, were formerly thought to be solely parasitic in other insects, but the

fact that they directly infest seeds has heen confirmed by many investigators, including the Japanese observer, Inamura, in 1904. More than 20 species of the genera *Syntomaspis*, *Megastigmus*, *Eoxysoma*, *Prodecatoma*, *Decatomidea*, *Eurytoma* and *Bruchophagus*, have been recorded to have this hahit.

All these species have only one annual generation, and this may be due to the fact that they infest the seeds of annual plants. The adults always appear at the time when the seeds are still young and can therefore easily oviposit in them. The only species from Japan, hitherto recorded, are *Megastigmus* sp. by Riley, and *M. aculeatus*, Swed., hy Weiss. The occurrence in Japan of *Prodecatoma phytophaga*, Crosby, which was obtained from Japanese ivy in America, bas not yet been confirmed.

The following new species are described by the senior author (Yano):—*Callimome tsugae*, infesting *Tsuga sieboldi*; *Megastigmus cryptomeriae*, in *Cryptomeria japonica* and *Chamaecyparis obtusa*; *M. thuyopsis*, in *Thuyopsis dolabrata*; and *M. inamurae* and *Eurytoma laricis*, in *Larix leptolepis* and *L. dahurica*.

When infested, fruits such as apple or plum shrivel up, while in the case of conifers, the injury may be restricted to the seed only. The average degree of damage in Japan, according to statistics collected in 1913–1916, amounted to 94 per cent. in *Chamaecyparis obtusa*; in *Cryptomeria japonica* the maximum injury was 13 per cent. and the minimum 3·6 per cent.; in *Larix leptolepis* and in *Thujopsis dolabrata* the injury was 2 per cent. Statistics are wanting regarding other species of trees. Though these Chalcids are injurious to the seeds, they make it possible to distinguish new and old seeds, as the presence of exit-holes in them indicates material that bas been stored at least one year.

Fumigation with carbon bisulphide destroys this pest, but it also affects the vitality of the seed. Generally speaking, each larva only damages the seed in which it lives and does not infest others of the same cone. The sound and injured seeds may be separated by submerging in water or winnowing, and the latter should be burnt.

MATSUMOTO (S.). **Nashi no Shinkuimushi ni kwansuru kenkyu.** [Studies on the Pear Borer.]—*Rinji-Hokoku* [*Extra Report*], no. 19, *Okayama Agric. Expt. Sta.*, 5th June 1918, 22 pp., 3 plates.

Though the pear borer (*Nephopteryx rubrizonella*, Rag.) has been studied by various entomologists in Japan, the results arrived at do not agree with one another. The author has therefore made further investigations on this Pyralid moth with the following result. It appears twice a year and hibernates in the larval state in the buds, mainly in the flower-buds of the pear; this is contrary to the statements of Matsumura and Takahashi, who say that it winters in the egg-state, or the results published by the Agricultural Experiment Station of the Gunba Prefecture in which it is stated to pass the winter as a pupa. In the spring it bores into the newly developing buds, injuring two or three in the same manner. Towards the end of April it bores into the young fruit, ejecting its excrement from the burrow. The larva may injure three or four fruits in this way; it matures in the middle or

end of May and pupates within the fruit, which has been previously attached to the branch by silken threads.

The pupal period lasts about two weeks, and the adult emerges in the beginning or middle of June. The newly emerged moth lays a single egg on a fruit, which hatches after eight or nine days, and the larva again bores into the fruit. As by this time the fruit is larger, the larva can attain maturity in a single fruit, pupating within it in the middle of July; eight or nine days after pupation, at the end of July or beginning of August, the adult of the second brood appears. The newly emerged moth does not lay eggs on the fruit, but deposits a single egg (rarely two or three) on the buds or on the bark near the buds. The resulting larva penetrates immediately into the bud and causes it to wither. In this manner until the end of August or the beginning of September, it attacks one or two buds and attains a length of about 3 mm. Winter is passed in the bud within a white cocoon.

In the Okayama Prefecture infestation by this moth is confused with that by *Eucosma* (*Tmetocera*) *ocellana*, Sch., in the spring. The remedial measures hitherto recommended include the removal of the eggs, the use of kerosene emulsion or arsenic, the collection of infested fruits both on the tree and when fallen, and covering up the fruit. The author suggests the removal and burning of infested buds during autumn and winter, and the collection and destruction of larvae that are concealed in the flower-buds; these may be recognised by the falling of the scales surrounding them.

Moreira (C.). **A Sarasará de Pernas ruivas.** [The red-legged Ant, *Camponotus* (*Myrmothrix*) *rufipes*.]—*A Lavoura, Rio de Janeiro*, xxii, no. 1–2, 1918, pp. 45–51, 17 figs.

A recent report from the State of Espirito Santo states that *Camponotus rufipes*, Forel, is causing some damage in plantations. The nests usually occur on the boundary line between clearings and fields. In the clearings a species of *Chusquea* predominates and the nests are largely composed of the dried leaves of this plant, more or less loosely compacted on the exterior and worked to a felt-like material within. The nests may be burnt by driving a slanting hole through the centre into the underground portion and pouring in some petroleum which is then set alight. Fumigation with carbon bisulphide may be effected by means of a similar hole into which is thrust a closely-fitting tube of glass, metal or bamboo with an internal diameter of from $\frac{3}{5}$ to $\frac{4}{5}$ of an inch. After pouring in about $3\frac{1}{2}$ oz. of carbon bisulphide the tube is corked. Should one application prove insufficient a second will complete the work.

Schaffnit & Lustner. **Bericht über das Auftreten von Feinden und Krankheiten der Kulturpflanzen in der Rheinprovinz im Jahre 1915.** [Report on the Occurrence of Enemies and Diseases of cultivated Plants in the Rhine Province in 1915.]—*Bonn*, 1916, 67 pp. (Abstract in *Zeitschr. f. Pflanzenkrankheiten, Stuttgart*, xxviii, no. 1–2, 1st February 1918, pp. 28–30.)

During 1915 potato and beet fields were severely infested by *Euxoa* (*Agrotis*) *segetum*, though this cutworm was rare in the following

year. There were two very prolific generations of *Eriocampoides limacina*, pear and cherry trees being chiefly attacked. Nicotine-soap, especially in combination with lime-sulphur, proved the best spray against the vine moths, *Clysia ambiguella* and *Polychrosis botrana*. Calcium cyanamide was successfully used against the larvae of the weevil, *Otiorrhynchus sulcatus*. The vine scale, *Pulvinaria vitis*, was best dealt with by scrubbing and by spraying with a 10–15 per cent. solution of carbolineum. Both the vine midge, *Contarinia viticola*, and the oyster-shell scale, *Lepidosaphes ulmi*, were present; the former disappeared when the vines were treated with sulphur. The mite, *Eriophyes loewi*, occurred in gardens.

SEITNER (M.). **Ziele der angewandten forstlichen Entomologie.** [The Aims of Applied Forest Entomology.]—*Bericht Amtsantritts d. Rektors für 1916-17 der k.k. Hochschule für Bodenkultur, Vienna*, 1916, pp. 22–42. (Abstract in *Zeitschr. f. Pflanzenkrankheiten, Stuttgart*, xxviii, no. 1–2, 1st February 1918, pp. 74–75.)

This paper is a report of the author's inaugural speech as rector for the year 1916–17 of the Vienna High School for Soil Cultivation. In Prussia banding is adopted against *Lymantria monacha*, whereas this is not the case in Saxony and Austria; this is due to adaptation to different food-plants, *i.e.*, the pine in Prussia and the spruce in Saxony and Austria. It was found that in the outbreak of *Dendrolimus pini* in 1913–14 near Vienna the Tachinid parasite, *Blepharipoda scutellata*, Desv., played an important rôle, though it does not do so in north Germany. So far no means are available for combating the scale *Eulecanium (Lecanium) robiniarum*, Dougl., which severely injures *Robinia* planted to prevent the shifting of sandy soil.

It is very necessary that entomology in Austria should be organised on the lines adopted in the United States, and in recent years in Germany. There should be regular notification of insect injury and remedial measures must be initiated by the State.

WAHL (B.). **Die biologische Methode der Bekämpfung von Pflanzenschädlingen.** [The Biological Method of combating Plant Pests.]—*Verhandl., 4 Tag. Oesterr. Obstbau- u. Pomol.-Ges., Vienna*, 1914, 19 pp. (Abstract in *Zeitschr. f. Pflanzenkrankheiten, Stuttgart*, xxviii, no. 1–2, 1st February 1918, p. 75.)

This paper is a review of the important instances of the use of bacteria, fungi, insects and predaceous enemies in combating insect pests, and records all such cases as have occurred in Austria.

REH (L.). **Die wichtigsten Schädlinge des Gemüsebaues und ihre Bekämpfung.** [The more important Pests of Vegetables and Measures for combating them.]—*Hamburg*, 1917, 49 pp., 2 plates, 16 figs. (Notice in *Zeitschr. f. Pflanzenkrankheiten, Stuttgart*, xxviii, no. 1–2, 1st February 1918, pp. 75–76.)

Though primarily intended for popular consumption this booklet is stated to contain information of interest to entomologists.

NALEPA (A.). **Die Systematik der Eriophyiden, ihre Aufgabe und Arbeitsmethode. Nebst Bemerkungen über die Umbildung der Arten.** [The Taxonomy of Eriophyids, their Definition and Technique. With Observations on the Re-arrangement of the Species.]—*Verhandl. k.k. zool.-bot. Ges., Vienna,* lxvii, 1917, pp. 12–38. (Abstract in *Zeitschr. f. Pflanzenkrankheiten, Stuttgart,* xxviii, no. 1–2, 1st February 1918, pp. 76–78.)

The view that similar galls on different species of plants are due to different gall mites may prove to be incorrect. A comparison of the mites producing similar galls on allied host-plants will show the need of withdrawing many species now thought to be distinct. For instance, *Erineum oxycanthae* and *E. malinum* are due to the same mite—*Epitrimerus goniothorax,* Nal., and *E. malinus,* Nal., cannot be considered a separate species. On the other hand no species of mite has been observed to produce similar galls on non-allied plants. If different galls are present on one and the same leaf they must be considered to be caused by different mites. Dissimilar galls on the same host-plant are generally produced by specifically different mites, though this is not a universal rule. A great increase of individuals may lead some of them to modify their habits and to migrate to plant-organs not previously infested, giving rise in them to dissimilar galls ; this dissimilarity is probably due to a difference in the irritation set up. Widely dissimilar galls on plants belonging to the same plant-group are due to mites which are sometimes so similar morphologically that their genealogical relations are easily seen. For instance, nearly all the plant-galls of coniferous trees belong to the form-group of *Eriophyes pini.*

In order to clear up confusion two facts must be considered :—(1) Forms of the same type-species produce similar galls on various species of the same natural plant-family. The differences seen in the blister-mites of *Pyrus, Sorbus, Cotoneaster, Crataegus, Cydonia,* etc., cannot be recognised as specific characters. In the case of *Sorbus aria* and *S. aucuparia* these mites may show greater differences, for there is a physiological difference in that each variety can exist only on the species of host-plant peculiar to it. This view is supported by the fact that leaf-blisters are not found on *Crataegus oxyacantha* in the Vienna forests where this plant grows together with *Pyrus communis, Sorbus aria, Cotoneaster vulgaris,* etc., which are infested with these galls. (2) Forms of the same type-species produce morphologically different galls on the same or closely allied host-species. They are sharply differentiated biologically, while their morphological differences are unimportant. The author treats these as sub-species on a trinomial system *e.g., Eriophyes tiliae tiliae* and *E. tiliae typicus.*

NALEPA (A.). **Neue Gallmilben (32. Fortsetzung).** [New Gall Mites. 32nd Continuation.]—*Anzeiger Kaiserl. Akad. Wissensch., Vienna,* liii, 1916, pp. 283–284. (Abstract in *Zeitschr. f. Pflanzenkrankheiten, Stuttgart,* xxviii, no. 1–2, 1st February 1918, p. 78.)

Diptilomiopus javanicus, gen. et sp. n. (PHYLLOCOPTINAE), is recorded in the galls of *Eriophyes hemigraphidis,* sp. n., on the leaves of *Hemigraphis confinis* in Java.

ZISCHKA (K.). **Blütlausbekämpfung.** [Remedies against *Eriosoma lanigerum.*]—*Wiener landw. Zeitg., Vienna,* lxvi, 1916, p. 531. (Abstract in *Zeitschr. f. Pflanzenkrankheiten, Stuttgart,* xxviii, no. 1–2, 1st February 1918, p. 82.)

The following formulae are said to be suitable for dealing with *Eriosoma lanigerum*:—Fuhrmann's solution, containing 1 part lubricating fish-oil, 1 part horse fat, 3 parts spirits and some rock salt; tobacco-lye solution, prepared by boiling 5 lb. tobacco in 3 gals. water and adding 3 gals. of water in which 5 lb. of soft soap has been dissolved; and Krosig solution, prepared by boiling 7½ lb. tobacco in 3–4 gals. water, letting this cool and after removing the tobacco leaves, adding 22 spoonsful of 5 per cent. carbolic acid. The infested areas must be scraped and then painted with one of these solutions. The scrapings must be burnt.

FUNDA (F.). **Zur Blütlausbekämpfung.** [On combating *Eriosoma lanigerum.*]—*Wiener landw. Zeitg., Vienna,* lxvi, 1916, p. 559. (Abstract in *Zeitschr. f. Pflanzenkrankheiten, Stuttgart,* xxviii, no. 1–2, 1st February 1918, p. 82.)

The remedy recommended is a varnish prepared by dissolving resin in ordinary spirits. This is painted on, and after the solvent has evaporated, the fine coating that remains prevents the Aphids from moving.

SEITNER (M.). **Ueber Nadelholzsamen zerstörende Chalcididen.** [Chalcidid Destroyers of Pine Seed.]—*Centralblatt. f. d. gesamte Forstwesen, Vienna,* xlii, pp. 307–324, with figs. (Abstract in *Zeitschr. f. Pflanzenkrankheiten, Stuttgart,* xxviii, no. 1–2, 1st February 1918, pp. 86–87.)

Insect infestation in pine cones may be expected to be most severe when the seed crop has been decreased by external conditions. In the dry year of 1911 late frosts occurred in May and June and up to 50 per cent. of the scanty crop of spruce seed from Styria and Salzburg was infested by the larvae of *Megastigmus abietis,* Seitn., a new species distinct from *M. strobilobius,* Ratz. From fir seed *M. piceae,* sp. n., was taken; all stages of this species are described. Cypress seed from Dalmatia yielded *M. wachtli,* sp. n., already recorded by Wachtl in the seeds of *Cupressus sempervirens.*

The paper concludes with a key, mainly based on colour characters, to the 16 species of *Megastigmus* in the author's collection, most of which were bred by him.

BAKÓ, GÁBOR. **Újabb megfigyelések a kukoriczamoly** (*Pyrausta nubilalis,* **Hbn.)-ról.** [New Research and Observations on the Maize Moth, *Pyrausta nubilalis.*]—*Rovartani Lapok, Budapest,* xxiv, 1917, pp. 13–14. (Abstract in *Zeitschr. f. Pflanzenkrankheiten, Stuttgart,* xxviii, no. 1–2, 1st February 1918, p. 87.)

In Hungary the flight period of *Pyrausta nubilalis* begins in May and is over by July. The caterpillars are abundant early in July, the author having found the first batches of eggs on a maize leaf on 5th July from which the caterpillars hatched on 10th July.

KADOCSA (G.). **Aus meinen vorjährigen (1916) Zuchten.** [Breeding Results in 1916.]—*Rovartani Lapok, Budapest*, xxiv, 1917, pp. 15–16. (Abstract in *Zeitschr. f. Pflanzenkrankheiten, Stuttgart*, xxviii, no. 1–2, 1st February 1918, p. 87.)

The larvae of *Scythropia crataegella*, L., *Gelechia vepretella*, Z., and *Olethreutes achatana*, F., are recorded from *Cotoneaster horizontalis* in Budapest.

FULMEK (L.). **Erdraupen im Weingarten.** [Cutworms in Vineyards.]—*Mitt. k. k. landw.-bakter. u. Pflanzenschutzstation, Vienna*, 4 pp. (Abstract in *Zeitschr. f. Pflanzenkrankheiten, Stuttgart*, xxviii, no. 1–2, 1st February 1918, p. 88.)

Cutworm injury to grape-vines is unusual, but has been recorded in France, Austria and Germany since 1735. In 1914 the first shoots on vine stocks in many parts of Lower Austria were destroyed right down to the old wood. Up to 50 larvae were found on a single stock. *Euxoa* (*Agrotis*) *tritici* predominated, *E. segetum* being rare. These moths and their life-history are described, with particulars of the injuries produced. As regards remedies, the destruction of weeds in August and deep soil cultivation in the autumn are particularly important.

WAHL (B.). **Bekämpfung der Erdraupen.** [Measures against Cutworms.]—*Mitt. k.k. landw.-bakter. u. Pflanzenschutzstation, Vienna*, 1916, 7 pp. (Abstract in *Zeitschr. f. Pflanzenkrankheiten, Stuttgart*, xxviii, no. 1–2, 1st February 1918, p. 88.)

Vineyards in Austria have suffered from the attack of *Euxoa tritici*, the dwarf stocks with short shoots being those most injured. The attack may last till July. A copper sulphate and lime spray gives good results, and in one instance lime-sulphur proved successful. Where the infestation is limited to isolated areas, these may be surrounded with trenches 6 inches deep, filled with barley chaff, or smooth-sided trenches, from 10 to 12 inches deep, may be used to trap the cutworms.

MAGERSTEIN (V.). **Ueber das Auftreten der C-Eule.** [The Occurrence of *Agrotis c-nigrum*.]—*Wiener landwirt. Zeitg., Vienna*, lxvii, 1917, pp. 116–117. (Abstract in *Zeitschr. f. Pflanzenkrankheiten, Stuttgart*, xxviii, no. 1–2, 1st February 1918, p. 89.)

In January 1917 the larvae of *Agrotis c-nigrum* were found in large numbers on snow in Silesia. They were killed by the subsequent frosts and were readily devoured by birds. The large numbers appear to indicate that this cutworm must be of importance in injuring winter-sown fields.

LAHN (A. G.). *Dendrolimus pini*.—*Entomolog. Zeitschr.* xxxi, 1917, pp. 18–19 & 21–22. (Abstract in *Zeitschr. f. Pflanzenkrankheiten, Stuttgart*, xxviii, no. 1–2, 1st February 1918, p. 89.)

In 1916 *Dendrolimus pini* appeared in large numbers in the province of Posen (Prussia). The first caterpillars were observed on 22nd

March and three days later the main migration up the trees began, but the forest administration had previously tarred the pine trunks at a height of just under 5 feet. In one locality where this precaution was neglected the trees were very severely damaged. The first adults appeared on 16th July and the chief emergence began on 22nd July and continued till mid-August, when it rapidly decreased. The first caterpillars appeared on 10th August, occurring also in areas previously uninfested. Early in September the descent of the trees in search of winter-quarters began. About 20–25 per cent. of these caterpillars were full-grown individuals, and were stragglers from the previous generation which were preparing to hibernate for the second time. This explains the presence of full-grown caterpillars in March. Of known enemies *Anomalon circumflexum* was rare, and this was also the case with Tachinid parasites. From mid-July onwards *Microgaster nemorum* was abundant in larvae and pupae. *Carabus auratus* was the most important of the predaceous Carabid beetles. Ants attack isolated caterpillars and adults. Rooks destroyed the larvae in some numbers, but only after defoliation was completed.

PFAFF (—). ***Aporia crataegi* in Rumänien.** [*Aporia crataegi* in Rumania.]—*Entomolog. Zeitschr.*, xxxi, 1917, p. 33. (Abstract in *Zeitschr. f. Pflanzenkrankheiten, Stuttgart,* xxviii, no. 1–2, 1st February 1918, p. 90.)

Aporia crataegi is abundant throughout Rumania, where the caterpillars often completely defoliate bushes and trees. About 20 per cent. of the pupae of this butterfly are killed by parasites.

NECHLEBA (—). **Anomalie in der Entwicklung und Lebensweise des grossen Kiefernmarkkäfers, *Hylurgus piniperda*.** [An Anomaly in the Development and Life-habits of *Hylurgus piniperda*.]—*Oesterr. Forst- und Jagdzeitg.*, xliii, 1916, p. 159. (Abstract in *Zeitschr. f. Pflanzenkrankheiten, Stuttgart,* xxviii, no. 1–2, 1st February 1918, p. 91.)

At Pürglitz (Bohemia) the young beetles do not bore into the interior of the tree in July and August, as usually stated, but do so during the second fortnight in May. The shoots of the previous year are those attacked and they wither in consequence.

WAHL (B.). **Spargelkäfer.** [Asparagus Beetles.]—*Wiener landw. Zeitg., Vienna,* lxvi, 1916, p. 267. (Abstract in *Zeitschr. f. Pflanzenkrankheiten, Stuttgart,* xxviii, no. 1–2, 1st February 1918, p. 91.)

The following insecticides are recommended against the larvae of the asparagus beetle [*Crioceris asparagi*]:—A 1 per cent. solution of Saxonia lead arsenate; a solution of $\frac{1}{2}$ oz. Katakilla in 5 pints water; or a solution of 5 lb. tobacco extract and 1 pint lysol in 50 gals. water, the last-named being the cheapest.

Apfelbeck (V.). **Biologische Forschungen über Borkenkäfer in den bosnischen Nadelholzforsten 1916.** [Biological Investigations on Bark Beetles in Coniferous Forests in Bosnia in 1916.]—*Centralbl. f. d. gesamte Forstwesen, Vienna*, xlii, 1916, pp. 429–439. (Abstract in *Zeitschr. f. Pflanzenkrankheiten, Stuttgart*, xxviii, no. 1–2, 1st February 1918, pp. 91–92.)

In consequence of the War large stacks of timber have accumulated in the coniferous forests in East Bosnia and provided breeding places for bark-beetles. In many districts *Ips typographus* does not live on spruce but on *Pinus sylvestris.* In the spruce woods broken branches, tops, fence timber, and many ringed trunks provide shelter for *Pityogenes chalcographus* and *Pityophthorus micrographus.* As a general rule the primary pest in older spruce and firs is *Pityogenes chalcographus*, which attacks the crowns of strong, healthy trees and opens the way for infestation by *Ips typographus.* In poles *Pityophthorus micrographus* or *Polygraphus polygraphus* effect this. In black pine, *Pityogenes pilidens,* and in white pine, *P. chalcographus* and *P. quadridens*, appear to prepare the way for other bark-beetles, such as *Ips mannsfeldi* and *I. sexdentatus.* These branch- and top-breeders also attack young growth.

Natural enemies include parasitic Hymenoptera; the Cucujid, *Laemophloeus alternans*, in the mines of *I. vorontzowi*; the Tenebrionid, *Hypophloeus linearis,* in the mines of *P. chalcographus*; the Histerid, *Plegaderus vulneratus*, in the mines of *I. curvidens* and *Crypturgus*; and some Staphylinids. The paper concludes with a systematic list of the bark-beetles infesting conifers.

Parst (—). **Die Fichtegespinstblattwespe (*Lyda hypotrophica*, Htg.) im Roggenburger Forst.** [*Cephaleia abietis* (*Lyda hypotrophica*) in the Roggenburg Forest.]—*Zeitschr. angewandt. Entomologie*, iii, 1916, pp. 75–96, 4 figs.

Scheidter (F.). **Beiträge zur Biologie und Anatomie der Fichtengespinstblattwespe, *L. h.*, Htg. (= *Cephaleia abietis*, L.).** [Contributions to the Biology and Anatomy of *Cephaleia abietis*, L.]—*Idem*, pp. 97–116, 4 figs. (Abstracts in *Zeitschr. f. Pflanzenkrankheiten, Stuttgart,* xxviii, no. 1–2, 1st February 1918, pp. 93–94.)

The Roggenburg Forest in Swabia is at an altitude of 1,600 feet and consists chiefly of spruce. In 1911 defoliated tops and branches were noticed in 119-year-old trees. The injury began to diminish at the time it was observed and no cause could be found until the sawfly, *Cephaleia abietis*, was seen in large numbers. All stands, including quite young ones, were infested, but the old ones—especially those of 80 years—were chiefly involved. The number of larvae in the soil varied even under one and the same tree from 480 to 2,073 per square metre. The defoliation is not injurious, because only the previous year's leaves are eaten, so that complete defoliation is followed in the spring by green leaves. Feeding occurred in June and July chiefly. In August the larvae migrate to the soil and remain there till the second following spring (20–21 months). They do not spin a web. Pupation takes place 10–14 days before the change to the adult stage, but the preparations for pupation begin in the preceding

autumn, and in March and April the pupal eyes are easily seen in the larva. As there are always at least two generations of larvae in the ground the pupal eyes must be looked for when making a count with a view to ascertaining the probable extent of the prospective emergence of adults. The flight period lasts from late March to late September, June being the chief time. Remedial measures are unnecessary and would be difficult to carry out. Banding is useless. Great care is required against the destructive beetles which follow injury by these sawflies.

ARNDT (A.). **Häufiges Vorkommen der Adlerfarnwespe,** *Strongylogaster cingulatus*, **Fab.** [The frequent Occurrence of *Strongylogaster cingulatus*, F.]—*Zeitschr. f. wiss. Insektenbiologie*, xiii, 1917, p. 136. (Abstract in *Zeitschr. f. Pflanzenkrankheiten, Stuttgart*, xxviii, no. 1–2, 1st February 1918, p. 95.)

In June 1916 some pines near Berlin showed a red colouring of the trunk up to a height of 6 or 7 feet. This was found to be due to numbers of the larvae of the sawfly, *Strongylogaster cingulatus*, which had eaten their way into the bark. The larvae migrate from bracken and pupate in pine bark.

ESCHERICH (K.). **Die Ameise. Schilderung ihrer Lebensweise.** [The Ant. A Description of its Life-Habits.]—Friedr. Vieweg u. Sohn, *Brunswick*, 1917, 2nd revised edition, xvi + 348 pp., 98 illustrations. Price 10 mks. (Notice in *Zeitschr. f. Pflanzenkrankheiten, Stuttgart*, xxviii, no. 1–2, 1st February 1918, pp. 95–96.)

The indirect importance of ants in phytopathology is much greater than their direct importance. Two supplements to this book deal with ants as house and garden pests and review the species native to Germany. The latter supplement contains a valuable key and many biological notes. The chapter on the relation of ants to other insects and to plants is of special value.

LESNE (P.). **Les Insectes nuisibles aux Arbres fruitiers.** [Insects damaging Fruit-trees.]—*Jl. Agric. Pratique, Paris*, xxxi, no. 14, 11th July 1918, pp. 269–271, 1 plate.

This article deals with the scale-insects, *Lepidosaphes ulmi*, L. (oyster-shell scale) infesting pear, apple and poplar trees; *Aspidiotus ostreaeformis*, Curt., and *Epidiaspis* (*Diaspis*) *piricola*, Del G., chiefly attacking pear, apple and peach trees. All of these are native species and have been successfully controlled by spraying with an emulsion composed of black soap, 200 parts; water, 600 parts; seed oil, 150 parts; ordinary petrol, 100 parts. Other imported scales are *Aspidiotus perniciosus*, Comst. (San José scale), and *Icerya purchasi*, Mask. (cottony cushion scale).

Eriosoma (*Schizoneura*) *lanigerum* (woolly apple aphis) is the chief permanent local pest of apple trees, but it can be controlled by removing and carefully burning the old bark in winter, afterwards white-washing the aerial portions of the trees and also the upper part of the roots, which must be exposed to a depth of 10 inches, with a mixture of black

soap 10 lb., petrol 1 gal., and water 10 gals. They can also be destroyed by spraying with hot water at from 140° to 149° F., a treatment which does not injure the trees.

Good results have been obtained by filling up the crevices in the bark in autumn with the following mixture:—Rain-water 5 pints; black soap 35 oz.; sodium sulphoricinate 5 oz. The base of the roots should be watered with a mixture of rain-water 5 pints; potassium carbonate $\frac{2}{5}$ oz.; sodium sulphoricinate 3 oz.; methylated spirit 2 oz.; nicotine (of standard strength 2 oz. per pint) 1 oz., the same liquid being also suitable for use as a spring spray.

Department of Entomology.—*43rd Ann. Rept. (1917), Ontario Agric. Coll., Toronto,* 1918, pp. 18–24.

Insect pests were not markedly abundant during the year under review, the severity of the previous winter and the late spring and summer undoubtedly reducing the numbers of many species. *Contarinia (Diplosis) tritici* (wheat midge) appeared in several new counties. This midge oviposits when the ears are formed on the growing grain, at the tip of the husk covering the soft kernel. The larvae hatch in about a week, enter the grain and feed on the contents, leaving only the husk. When full-grown, they descend to the ground, pupate a few inches below the surface and remain dormant during the winter. Many larvae remain in the heads after the grain is ripe and are cut down with it. The maggots cannot be destroyed when in the ear, and preventive measures are the only practicable course. It is essential that all chaff and refuse from the threshing machine be swept up and burnt immediately. If possible, the stubble in the field should be burnt over and the field should be deeply ploughed in order to bury the pupae too far for the flies to emerge in the following year. After ploughing, the ground should be rolled and wheat should not be sown on the same field for one or two seasons. The wheat known as Red Fife is considered the most resistant to attacks by *C. tritici.*

Datana integerrima (checkered tussock worm) defoliated walnut and butter-nut trees. *Schizura concinna* (red-humped caterpillar) was abundant on fruit trees in many localities and should be shaken off the trees and destroyed. *Ceramica (Mamestra) picta* (zebra caterpillar) was present in large numbers on cabbages, beets, turnips and other vegetables. The best results were obtained by dusting with Paris green diluted with about 30 parts air-slaked lime, hydrated lime, or land-plaster (gypsum). The larvae of the moth, *Depressaria heracleana,* caused much destruction to the flowers of parsnips, spinning a web over them and devouring them and then boring into the stems. All affected heads should be cut off and burned, and wild parsnips or other umbelliferous flowers in the vicinity should be cut down and destroyed.

In green-houses the larvae of the Pyralid, *Pionea (Phlyctaenia) ferrugalis,* have been troublesome on chrysanthemums; the fern scale (*Hemichionaspis aspidistrae*) has also appeared in some conservatories. Among household pests, *Lepisma* sp. (silver-fish) has been found damaging wall-paper, the binding of books and some starchy foods. Sodium fluoride proved successful against this pest and also against cockroaches.

In the field, experiments in dusting versus spraying were carried out for the control of fruit-tree insects. Practically no difference in results from the two methods was observed in the case of the codling moth (*Cydia pomonella*), while San José scale (*Aspidiotus perniciosus*) was completely controlled by sodium sulphide and talc dust, though this might not be the case every year. The substitution of dusting for spraying is not on the whole recommended.

The blackberry leaf-miner [*Fenusa*] has been destroying a large percentage of the foliage in infested fields. It is believed that lead arsenate destroys the adults, and experiments with this poison will be made next year. The apple maggot [*Rhagoletis pomonella*] can be controlled by spraying with lead arsenate when the adults begin to appear and again two weeks later. The parasites of San José scale were very abundant, particularly *Prospaltella perniciosi*. It is known that a moderate breeze will carry the larvae of this scale some 50 feet and it is hoped to make more accurate tests as to this.

WICKHAM (H. F.). **An Interesting New Species of *Eleodes*. (Col., Tenebrionidae.)**—*Entom. News, Philadelphia,* xxix, no. 7, July 1918, pp. 255–257.

The beetles of the genus *Eleodes* have not been hitherto regarded as very injurious to field or forage crops, but the larvae have recently been found doing considerable damage to wheat [see this *Review*, Ser. A, vi, p. 307]. This paper describes *Eleodes barbata*, sp. n., which has not yet been reported as troublesome.

Entomological Gleanings from all Quarters of the Globe.—*Entom. News, Philadelphia,* xxix, no. 7, July 1918, pp. 271–274.

In Virginia indications point to the fact that a continued low temperature is more fatal to wood-boring Cerambycid larvae than fluctuating low temperatures, the fatal low temperature being from 15–20° F. below zero. There seems to be a greater mortality in exposed wood than in moist logs on the ground, the difference in humidity perhaps being an important factor. Milder winters in the neighbourhood of Washington seem to have more disastrous effects on the European pine sawfly (*Diprion simile*, Hartig).

In western Oregon, Aphids have appeared in the most serious outbreak experienced in recent years. *Acyrthosiphon* (*Macrosiphum*) *pisi* was especially numerous, and practically no type of crop or plant has escaped injury. Experimental work to control the insects took several forms. A wooden drag, 10 feet long and 18 inches wide, pulled by a horse through 12 acres captured 140 lb. of Aphids. A fungus, *Empusa aphidis*, Hoffm., is killing Aphids in great numbers, but apparently only in limited areas. *Macrosiphum creelii* appeared in great numbers on lucerne in Nevada. The rosy apple aphis [*Aphis malifoliae*] has been unusually abundant in Oregon and has injured apples in West Virginia. The green peach aphis [*Myzus persicae*] has been abundant in Washington. The melon aphis [*Aphis gossypii*] has caused damage in California, Texas and Alabama; the bean aphis [*A. rumicis*] has caused complaints in California, Ohio and New Jersey.

Cylas formicarius, F. (sweet potato weevil) has been studied and apparently does not fly long distances. *Euscepes porcellus*, Boh., which also attacks sweet potatoes in Jamaica, has been found on *Calonyction aculeatum* and *Ipomoea pescaprae* in southern Florida.

Other injurious insects occurring in great abundance include the fall webworm [*Hyphantria cunea*] in Florida, and the pecan-nut case-bearer (*Acrobasis hebescella*) in Texas, both on pecans; the blackhead fireworm [*Rhopobota vacciniana*] on cranberry in Washington; the larger stalk borer (*Papaipema nebris*) on tomato in Mississippi; the asparagus beetle (*Crioceris asparagi*, L.) in Maryland and Virginia; mealy bugs (*Pseudococcus*) and *Pulvinaria* sp. on figs in Louisiana, the Argentine ant [*Iridomyrmex humilis*] being a potent factor in the distribution of mealy-bugs; and grain pests (*Silvanus surinamensis* and *Calandra oryzae*) in warehouses in Oregon.

DE ARIS (C. B.). **Una Plaga de la Viña y de los Frutales. La Pulguilla** (*Altica amphelophaga*). [A Pest of Grape-Vines and Orchards, *Haltica ampelophaga*.]—*Bol. Agricultura Técnica y Económica, Madrid*, x, no. 113, May 1918, pp. 395–398. [Received 3rd July 1918.]

During 1917 the vineyards in Castile were infested more severely than usual by the vine flea-beetle, *Haltica ampelophaga*. This article contains notes on the life-history of this pest and describes various remedies, of which spraying with an arsenical solution is held to be the best. An economical formula—anhydrous sodium arsenate 2 lb., lime in paste 3 lb., water 50 gals.—is given with full directions for preparing it.

Reports on the State of the Crops in each Province of Spain.—*Bol. Agric. Técnica y Económica, Madrid*, x, no. 113, May 1918, pp. 423–445.

Prompt measures are needed in Alicante against *Haltica ampelophaga*. In Cordova evergreen oaks have suffered from the persistent attacks of *Lymantria* (*Liparis*) *dispar* and *Tortrix viridana*. The former moth has begun to do the same damage in Salamanca and Seville.

Vertilgung des Kohlweisslings. [The Eradication of Cabbage Butterflies.]—*Schweiz. Zeitschr. Obst- u. Weinbau, Frauenfeld*, xxvii, no. 13, 29th June 1918, p. 204.

The Swiss Department of National Economy issued in June 1918 an order prescribing the measures to be applied against the white cabbage butterfly [*Pieris*] with a view to preventing the loss, amounting to several millions of francs, sustained in 1917. The collection and destruction of the eggs and young caterpillars are especially aimed at, catching the adults being a less efficacious method, though one also provided for. The various Cantons are responsible for the carrying out of the work.

HERRICK (G. W.). **The Increasing Menace of Cherry Maggots.**—*Canadian Horticulturist, Toronto*, xli, no. 6, June 1918, pp. 149–150.

The cherry fruit-flies [*Rhagoletis cingulata* and *R. fausta*] first became serious pests in Canada in the late nineties, and have gradually become more widely distributed and more prevalent, attacking all the late sour and sweet varieties of cherry rather than the early ones. The flies appear early in June and oviposit just under the skin of the fruit, the larvae later burrowing in the fruit and causing it to decay, though frequently there is no external evidence of their presence.

They are easily controlled by poison-sprays, owing to their habit of eagerly sucking up drops of liquid from the leaves and fruit, and also to the fact that an interval of a week or ten days elapses between their emergence and oviposition. Tests have shown that the best spray consists of 2 or 2½ lb. lead arsenate, with or without ½ gal. cheap molasses to 40 gals. water, and this should be applied at the rate of 1 gal. for a large tree, during the early part of June, and again two weeks later. Though sweetened baits have proved admirably effective, the absence of molasses hardly affects their efficacy, while it reduces the cost and increases the adhesiveness. To obtain the best results, such spraying should be compulsory throughout a community, as owing to the activity of the flies, an unsprayed orchard is a source of re-infestation.

BURGER (O. F.) & SWAIN (A. F.). **Observations on a Fungus Enemy of the Walnut Aphis in Southern California.**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 3, June 1918, pp. 278–289.

Chromaphis juglandicola, Kalt. (walnut aphis) was so abundant in certain walnut-growing sections of S. California in the spring and early summer of 1917, that in many places remedial measures were instituted. Dusting with a mixture of dry sulphur and tobacco dust, and spraying with nicotine sulphate and lime-sulphur, or with nicotine sulphate and soap, gave good results. However, shortly afterwards it was noticed that living Aphids were no more abundant on untreated than on treated trees, to both of which very many bodies of dead individuals were clinging, and these proved to be infected with a fungus, a new species of *Entomophthora*.

Among the natural agencies which contribute to the control of *C. juglandicola*, the heat of summer must be regarded as very important in certain localities, since the Aphids thrive best in cool, humid weather, and it was before the period of extreme heat that in one place 88 per cent. of them were killed by this fungus.

Insect enemies, especially predaceous ones, are a very important factor in the control of this Aphid, especially the Coccinellid, *Olla abdominalis*, Say, the larvae of which feed extensively upon it during the latter part of May; *Hippodamia convergens*, Guér., the larvae and adults of which are present from May to September; *Chrysopa californica*, Coq. (green lace-wing), very plentiful in May and June; the larvae of various Syrphid flies, particularly *Lasiophthicus (Catabomba) pyrastri*, L., and occasionally larvae of *Sympherobius angustus*, Bks.; and adults and larvae of *Scymnus* sp.

Practically three months after the hot period, it was found that the Aphids had been able to effect an extensive re-infestation, the

fungus, though present, being a negligible factor in control. The practical absence of the fungus, due to the summer heat and drought, was a matter of small moment, since Aphid infestations at that time of year are of no commercial importance.

DAVIDSON (W. M.). **Alternation of Hosts in Economic Aphids.**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 3, June 1918, pp. 289–294.

True alternation of generations among Aphids implies a summer host or hosts, supporting only actively feeding generations through the summer and autumn, and a winter host or hosts harbouring the egg or dormant stage. Frequently there is more than one summer host and these are not necessarily closely related botanically, while on the other hand winter hosts are generally few, and if more than one, closely related. Thus *Phorodon humuli*, Schr. (hop aphis) alternates between hop and plum, and *Myzus cerasi*, F. (black cherry aphis) between cherry and *Lepidium*, a small crucifer. Again the summer forms of *Myzus persicae*, Sulz. (spinach aphis) are equally at home on lettuce (Compositae), turnip (Cruciferae) or parsley (Umbelliferae); while *Aphis rumicis*, L. (bean aphis) feeds alike on Leguminosae and Chenopodiaceae in summer.

In many species complications arise through the insects living all the year round on the summer host or hosts, a habit common to all the root-inhabiting species. Thus *Pemphigus betae*, Doane (beet aphis) normally winters on *Populus*, but colonies may appear on beet or other roots at any time of the year; similarly *Eriosoma lanigerum*, Haus., and *E. pyricola*, B. & D., pass the winter in a dormant state on elms, and in an active state on apple and pear, the normal summer hosts respectively. In certain districts of California where both these species abound, the spring forms of *E. lanigerum* (apple woolly aphis) are rarely found on elm, the reverse being true of the spring forms of *E. pyricola* (pear woolly aphis).

In the south and south-western parts of the United States the semi-tropical climate allows of Aphids feeding and reproducing through the winter months, and thus several species that in the north hibernate in the egg-stage on their winter hosts in the south pass the whole year on their summer hosts without any pause in reproductive activity. Thus *Myzus persicae* in the north hibernates in the egg-stage on stone fruits, which suffer much damage from the resultant spring generations, but which, in the south, escape injury owing to the Aphids feeding all the year round on vegetable crops and weeds without migrating. *Aphis prunifoliae*, Fitch (oat aphis) is another such species that winters in the north on apple, but in the south completes its life-cycle on grasses and grains, apples in the semi-tropical zone thereby escaping injury. However, owing to their viviparous reproduction throughout winter, both these species occur on the summer hosts in greater abundance in the south than in the north, the heavier infestation of vegetable and grain crops thus counterbalancing the absence of injury to fruit trees.

Both the above-mentioned species belong to that group in which both the winter and summer hosts are plants of economic importance, others being *A. bakeri*, Cowan (clover-apple aphis), wintering on apple

and reproducing on clovers, and *Phorodon humuli*, alternating between plum and hop, and chiefly injurious to the latter.

Another group contains species of which the summer hosts alone are of economic importance, such as *Macrosiphum solanifolii*, Ashm. (potato aphis), infesting tomato, potato, egg-plant, cotton and lettuce, and *M. granarium*, Kirby (grain aphis), infesting grains and grasses, species that in the north migrate in autumn to roses, but in the south remain on their summer hosts. In California they feed and reproduce in the winter both on roses and on their summer hosts. Other members of this group are :—*A. cerasifoliae*, Fitch (possibly a synonym of *A. padi*, L.), on grains and grasses and hibernating on choke-cherry ; *A. rumicis*, attacking many varieties of beans and wintering on *Euonymus* in temperate climates ; *Rhopalosiphum capreae*, Kalt. (parsley aphis), sometimes a pest on umbelliferous crops, and wintering on willows ; *Macrosiphum illinoisense*, Shimer (eastern grape aphis) migrating in the autumn to, and ovipositing upon, *Viburnum opulus* ; *Pemphigus betae*, Doane (beet aphis) ; and *Eriosoma lanigerum*, Haus., and *E. pyricola*, B. & D.

A third group contains those species whose winter hosts alone are economic plants, such as :—*Rhopalosiphum lactucae*, Kalt., which migrates between currant, gooseberry and sow-thistle (*Sonchus*) ; *Myzus ribis*, L., wintering on currants and migrating to and from *Stachys* and *Leonurus* (Menthaceae) ; *Aphis malifoliae*, Fitch (rosy apple aphis), migrating between apples and rib-grass and plantains ; *Aphis setariae*, Thomas (rusty plum aphis), passing the summer on grasses ; *Hyalopterus arundinis*, F. (mealy plum aphis), *Rhopalosiphum nymphaeae*, L. (reddish-brown plum aphis), and *Aphis cardui*, L. (green plum aphis), passing the summer respectively on reeds, water-plants and thistles.

Of the above twenty-one species, at least fourteen, and possibly fifteen or sixteen, are common to Europe and America, while strictly European economic species with alternate host-habits have not been dealt with.

QUAYLE (H. J.). **Cyanide Fumigation : Diffusion of Gas under Tent and Shape of Tree in Relation to Dosage.**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 3, June 1918, pp. 294–299, 1 fig., 1 plate.

Owing to the variable results obtained in practice, it was found necessary to determine experimentally the relation between the dosage and the shape of the tree, since the latter varies between such wide limits, as that of the low and broad lemon tree– the circumference of which is twice the distance over the top—to that of the orange seedling, where the circumference and the distance over the top are equal. At the same time it was required to discover the killing power at different levels within the tent, which was effected by placing insects one foot from the top, one foot from the bottom, and at the centre.

In these experiments frameworks measuring 31 feet by 31 feet and 22 feet by 44 feet were covered with octagonal fumigation tents, both tents being charged at the same time.

The results showed little difference in the killing efficiency of the gas at the top and centre of the tall tree, but a great difference between that obtaining in these positions and at the bottom of the tree, probably

owing to the fact that on a tall and narrow tree more of the tent area is disposed in folds near the ground, and these may be loose enough to allow the gas to diffuse between them, resulting in a reduction of killing efficiency of 26·9 per cent. In the case of the low and broad tent there was a difference of 18·9 per cent. between the top and bottom of the tent, and between the two tents a difference of efficiency, in favour of the low tent, of 19·4 per cent.

The unsatisfactory results obtained with insects on low and broad trees, together with complaints of injury to the tops of tall trees, owing to the accumulation of the gas which is lighter than air, are due to faulty dosage tables based on the circumference and distance over the top of the trees, data which give neither the true cubic content nor the internal area of the tents when in position.

SEVERIN (H. H. P.) & THOMAS (W. W.). **Notes on the Beet Leaf-hopper, *Eutettix tenella*, Baker.** *Jl. Econ. Entom., Concord, N.H.*, xi, no. 3, June 1918, pp. 308–312.

An investigation was undertaken to determine the hibernating sites of *Eutettix tenella* (beet leaf-hopper) and to locate its breeding-places in the State of California, since the view has been held that it breeds in arid or desert regions and that the migration of enormous numbers of this pest have caused three serious and widespread outbreaks of curly-leaf of beet in California and one in Utah in 1915, from flights from the California outbreaks in 1914.

As a result it was found that the insect breeds on *Atriplex semibaccata* (Australian salt bush) in January and March, and on *Sesuvium sessile* (lowland or sea purslane) in March in the cultivated districts of the Imperial Valley, though no complete hibernation occurs there.

The names are also given of a large number of wild plants on which after careful examination it was not found to occur.

DOANE (R. W.). **Some Problems in the Control of Insects in Stored Foods in California.**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 3, June 1918, pp. 313–320.

The most important insect pests attacking stored food in California are:- The Mediterranean flour moth [*Ephestia kühniella*], the larvae of which mat together the flour in bins and sacks with masses of webbing, and puncture the sacks on emerging to seek suitable places for pupation; *Calandra oryzae*, L. (rice weevil); *C. granaria*, L. (granary weevil), which usually occurs only in small numbers; *Silvanus surinamensis* (saw-toothed grain beetle), commonly associated with the preceding and sometimes very abundant and destructive; *Tribolium confusum* (confused flour beetle), a general feeder, attacking nearly all kinds of food products; *T. navale*, F., the presence of which imparts a disagreeable musty odour to food, bread baked from infested flour having a disagreeable odour, which however disappears as it cools; other unidentified moths and beetles, and a mite, probably *Tyroglyphus longior*, Ger.

Preventive measures consist, primarily, of cleanliness and a careful watch on all incoming material. The former is attained in many

cases by the use of compressed air for cleaning out machinery and all cracks and crevices in floors and walls, and by the treatment of the floors at regular intervals with gasoline or kerosene; while the latter includes the careful inspection of used sacks, which should be thoroughly cleaned or fumigated before being taken to the store-room.

Difficulties in the way of fumigation by means of carbon bisulphide may arise owing to underwriters refusing to insure against risks from fire if this material is on the premises, and in the case of hydrocyanic acid gas, either the building is not sufficiently air-tight for fumigating, or the stored food contains too much moisture to render the process practicable. The best method involves the construction of small fumigating rooms about 8 × 10 ft. where a temperature of from 130°-140° F. can be maintained for several hours, the destruction of the pests being effected by means of heat alone.

SWAIN (A. F.). **Fumigation Experiments: the Time Factor.**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 3, June 1918, pp. 320-324.

From a series of 44 experiments on a total of 7,485 insects carried on in the day-time with models of trees covered with tents, in which both Coccinellids (*Hippodamia convergens*) and red scale (*Chrysomphalus aurantii*) were experimented with, it was shown that an exposure to hydrocyanic acid gas for 30 minutes was not sufficient to obtain the highest killing efficiency. It was found however, that with 45 minutes as good results were obtained as with 60 and 90 minutes. From an examination of the results of commercial fumigation against *Coccus citricola* (citricola scale) in 125 groves during the 1917 season, it was learned that there was no practical difference between the killing efficiency of the hydrocyanic acid gas with exposures of 45, 50 and 55 minutes.

It may therefore be concluded that under normal conditions for commercial fumigation, a 45 minute exposure is fully as efficient as one of 50 or 55 minute.

SEVERIN (H. H. P.). **A Native Food-Plant of *Rhagoletis fausta*, O.S.**—*Jl. Econ. Entom., Concord, N.H.*, xi no 3, June 1918, pp. 325–327.

Rhagoletis fausta (northern or black-bodied cherry fruit-fly) is a serious pest of cultivated cherries, but one which in Ontario has not been found to cause injury to any of the native wild varieties of cherry, but only to the imported ones, or those that have grown up wild from the seeds or roots of these. Since this Trypetid occurs in the alpine regions of the White Mountains, its natural food-plant would obviously seem to be species of wild cherry or plum, or the berries of some species of *Berberis* or *Lonicera*, especially since the larva of *R. cerasi* (European fruit-fly) lives in cherries, *Lonicera xylosteum* and *Berberis vulgaris*.

An examination of *Prunus pennsylvanica*, L. (wild red, bird, fire or pin cherry), showed that most of the fruit had been punctured by insects, and when ripe, about a quart of these wild cherries were scattered in sterilised sand in jars towards the end of July. During

August numerous yellowish puparia were sifted from the sand and were kept in moist sterilised sand over the winter, the adults of *Rhagoletis fausta* issuing, under laboratory conditions, during the following spring; similar puparia kept in dry sand failed to develop. *Prunus virginiana*, L. (choke cherry) and cultivated cherries failed to yield *R. fausta*.

As regards distribution, the recorded range of *R. fausta* in New Hampshire and New York, and in Canada from Montreal to British Columbia, lies well within that of *P. pennsylvanica* which occurs from Newfoundland to the Fraser River Valley in British Columbia, and in the United States from Pennsylvania southward to the high mountains of North Carolina and Tennessee, and westward to the eastern slopes of the Rocky Mountains of Colorado. This plant is common in all the forest regions of the extreme northern States, growing in moist, rather rich soil, often occupying, to the exclusion of other trees, large areas of the original forest cleared by fire. It is common and attains its largest size in Tennessee, and occurs at an altitude of 4,000 to 9,500 ft. in Colorado.

Gillette (C. P.) & Bragg (L. C.). *Aphis bakeri* **and some allied Species.**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 3, June 1918, pp. 328–333, 2 figs.

This paper deals with several forms closely allied to *Aphis bakeri* and gives a key for their separation. The species dealt with are:— *A. helichrysi*, Kalt. (*myosotidis*, Koch, *marutae*, Oest.), which feeds chiefly, but not exclusively, upon Compositae, the types described by Kaltenbach having been taken from *Helichrysum chrysanthemum*, *Tanacetum balsamita*, *Anthemis tinctoria* and *Achillea ptarmica* in Europe, while in Colorado it often occurs in special abundance on *Ambrosia artemisifolia* and *Erigeron canadense*, and on the cultivated plants, *Tanacetum balsamita* and *Cineraria*. A peculiarity of this Aphid is that the secretion is hard instead of being liquid and gives a frosted appearance to the foliage on which it accumulates. No evidence of the existence of either sexual forms or eggs has been found.

The summer food-plant of *A. viburnicola*, Gill., a species abundant every spring upon snowball bushes (*Viburnum*), has not yet been discovered. All the young of the stem-mother acquire wings and leave the curled leaves for some other food-plant. The autumn migrants begin to return early in September, the males coming a little later, when the earliest oviparous females are about half-grown.

A. sensoriata, sp. n., is described from specimens infesting the leaves of *Amelanchier* sp. in Colorado at an altitude of 8,000 to 8,800 ft. The July individuals are all wingless and viviparous, and the October ones include winged autumn migrants, winged males and oviparous females. This species is very closely allied to *A. viburnicola*.

A. bakeri, Cow. (*cephalicola*, Cow.) lives throughout the year on clover and gives rise to migrants to apple and *Crataegus* in the autumn. In some years it becomes quite injurious to red clover, this having been the case in north-eastern Colorado and parts of Idaho and Utah in 1916, when the crops in some cases were almost ruined.

A. crataegifoliae, Fitch (*brevis*, Sand.) does not occur in Colorado, but has been taken on *Crataegus* in Illinois and Maine.

Burke (H. E.). **Biological Notes on some Flat-headed Wood-borers of the Genus** *Buprestis.*—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 3, June 1918, pp. 334–338.

About 21 species of *Buprestis* are said to occur in the United States north of Mexico, 17 of which have been collected and described within the last fifteen years. All the species are wood-borers, and, so far as known, are able to oviposit directly in the crevices of the wood, as the young larvae can thrive without any bark food. Eggs, however, are often placed under or in crevices of the bark, whence the larvae can easily reach the wood.

Observations show that at least two, or it may be any number up to fifteen or even twenty, years are passed in the larval stage, and probably some larvae from almost every group of eggs undergo a retarded development and emerge as beetles from one to several years after the main brood.

A study of the larval characters and biologies indicates that the genus should be divided into three groups, corresponding with those formerly made from a study of the adult characters alone. In the first group are those species in which pupation takes place in the spring, the beetles emerging shortly afterwards; while those in the other two groups, which differ from each other in morphological characters, agree in that pupation takes place in the summer, the beetles remaining in the pupal cells till the following spring.

Taken as a whole, the species of the first group mine chiefly in dead dry wood and seldom cause serious injury; on the contrary their presence is often beneficial, since they mine stumps on partly cleared land, causing rapid decay and facilitating removal. The species of the other two groups, however, often attack slightly injured trees and cause severe damage to the wood.

The species dealt with include:—*Buprestis rufipes*, Oliv., which mines in dead wood, occurring in hickory (*Hicoria* sp.), beech (*Fagus atropunicea*), chestnut (*Castanea dentata*), white oak (*Quercus alba*), live oak (*Q. virginiana*), and tulip tree (*Liriodendron tulipifera*), also damaging the wood of standing dead trees and of chestnut telephone and telegraph poles; *B. gibbsi*, Lec., a rare species that flies in July and August and has not yet been reared, occurring on black cottonwood (*Populus trichocarpa*) and black oak (*Q. californica*); *B. confluens*, Say, which flies from July to September and lives for several years in the wood as a larva, pupating in the spring and occurring on aspen (*Populus tremuloides*) and common cottonwood (*P. deltoides*), mining in the wood of injured, dying and dead trees; *B. lineata*, F., a beneficial insect mining the wood of injured, dying and dead trees, especially loblolly pine (*Pinus taeda*), scrub pine (*P. virginiana*) and long-leaf pine (*P. palustris*), and pupating and transforming to the beetle stage from April to June; *B. consularis*, Gory, occurring in dying and dead yellow pine (*Pinus ponderosa*) and Douglas spruce (*Pseudotsuga taxifolia*), especially in those trees attacked by Scolytids; *B. connexa*, Horn, in stumps and felled trees of western yellow pine (*Pinus ponderosa*) and Jeffrey pine (*P. jeffreyi*); *B. laeviventris*, Lec., a beneficial species mining in injured, dying and dead trees of sugar pine (*P. lambertiana*), yellow pine (*P. ponderosa*), lodge-pole pine (*P. murrayana*), digger pine (*P. sabiniana*) and Monterey

pine (*P. radiata*), and pupating and transforming to beetle stage from March to July; *B. maculiventris*, Say, flying from July to September in forests of yellow pine; *B. subornata*, Lec., flying from July to October and mining the wood of dead yellow pine; *B. rusticorum*, Kirby, mining the wood of dead and dying trees of the true firs, especially Douglas spruce, alpine fir (*Abies lasiocarpa*), lowland fir (*A. grandis*) and white fir (*A. concolor*), pupating and transforming to the beetle stage from April to July; *B. langii*, Mann., flying from June to September and taken on alder and willow leaves and on the bark of pine and spruce trees, but never reared from the wood; *B. aurulenta*, L. (*lauta*, Lec.), occurring throughout the range of its primary host, the Douglas spruce, and doing considerable damage to the wood of injured trees by mining the pitchy scars, and living for years as a larva in the wood, especially in western white pine (*P. monticola*), sugar pine, yellow pine, Jeffrey pine, lodge-pole pine, digger pine, Monterey pine (*P. radiata*), blue spruce (*Picea parryana*), and Sitka spruce (*P. sitchensis*), pupating and transforming during the summer and early autumn and over-wintering as a beetle in the pupal cell in the wood, emerging during the following spring and summer; *B. villosa*, Lec., apparently described from a woolly specimen of *B. aurulenta*, such specimens occurring frequently among typical ones; *B. adjecta*, Lec., mining the wood of yellow pine; *B. apricans*, Hbst., mining the wood of injured, dying and dead trees of loblolly pine and long-leaf pine (*P. palustris*), pupating and transforming in the summer and autumn, over-wintering as a beetle in the pupal cell in the wood and emerging in early spring, living for several years as a larva in the wood and causing considerable damage to the wood of injured trees.

Essig (E. O.). **The European Earwig,** *Forficula auricularia*, **L.**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 3, June 1918, p. 338, 1 plate.

Forficula auricularia (European earwig) has been known for several years in the eastern United States and also occurs in the north-western portions, having been received in 1916 in considerable numbers from Seattle, Washington, where it is abundant in houses and very destructive to roses. Since this insect is capable of travelling long distances without injury when closely packed up, collectors and the general public should be on their guard against its accidental introduction into new localities.

Moore (W.). **A Promising New Contact Insecticide.**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 3, June 1918, pp. 341–342.

A new contact insecticide, nicotine oleate, having the form of a soap, or soap-like salt, has been obtained by the union of nicotine and oleic acid. It is soluble in soft water, forming a soapy solution that may be used to emulsify an animal, vegetable, or mineral oil [see this *Review*, Ser. A, vi, p. 370].

In its preparation, any nicotine compound containing free nicotine may be used. Two and a half quarts of a 40 per cent. nicotine solution, costing about 29 shillings, can be mixed with $1\frac{3}{4}$ quarts of commercial

oleic acid costing about 4 shillings, making $1\frac{1}{4}$ gals. of nicotine oleate, a spray as effective for the control of Aphids, if not more so, than one containing free nicotine, and at less than half the cost.

Since nicotine oleate is not volatile, it should not be used as a spray on plants that are to be eaten, such as lettuce; while on dormant trees, its use with a rather non-volatile oil such as linseed, cotton seed or fish oil, should be valuable for the destruction of insect eggs or scale-insects.

Application has been made for a patent for this compound, and this, when obtained, will be given to the public so that anyone will be able to manufacture it.

SEVERIN (H. H. P.). **Oils tested to trap Trypetidae and Ortalidae.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento,* vii, no. 6, June 1918, pp. 419–423, 2 figs.

Within recent years, experiments in trapping fruit-flies by means of various oils have shown that in India, the males of *Dacus zonatus,* Saund. (peach fruit-fly) and *D. diversus,* Coq. (three-striped fruit-fly) were attracted by citronella oil, as was also *D. ferrugineus,* F. (mango fruit-fly), which ranges from India and Ceylon to Java, but that *Dacus (Bactrocera) cucurbitae,* Coq. (melon fly) in India and Ceylon never came to this oil [see this *Review,* Ser. A, iv, p. 66]. Observations on the effects of animal, vegetable, and crude petroleum oils on *Ceratitis capitata,* Wied. (Mediterranean fruit-fly) have already been noticed [see this *Review,* Ser. A, iii, p. 28].

Rhagoletis pomonella, Walsh (apple maggot), avoids oil of citronella and kerosene, but it was found that the exposure of crude petroleum in shallow pans for the purpose of repelling ovipositing females, resulted in their capture.

Exhaustive experiments extending over six weeks, with 41 different oils in specially prepared traps fitted with conical covers to exclude the rain, gave entirely negative results, one female only being taken in turpentine. It having been stated that in the case of *D. zonatus* and *D. diversus* the attractive principles of oil of citronella were iso-eugenol and methyl-eugenol, experiments were conducted on *R. pomonella* with these substances, but with negative results. Tests with these substances upon *Epochra canadensis,* Lw., under both laboratory and field conditions, gave entirely negative results, and the same was true of the hydrocarbons and oil of citronella in the case of *Straussia longipennis,* Wied. (sunflower fruit-fly) and the Ortalid, *Secptera colon,* Lw.

SEVERIN (H. H. P.). **Fruit Flies of Economic Importance in California. Apple Maggot** (*Rhagoletis pomonella,* **Walsh**).—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento,* vii, no. 6, June 1918, pp. 430–432, 1 fig.

Although there seems to be no doubt that the apple maggot, *Rhagoletis pomonella,* Walsh (*R. zephyria,* Snow), occurs in California, no reports of apples infested by the pest have been obtained at the

California Agricultural Experiment Station, and hence arises the question of the food-plant of this Trypetid in that State.

Observations have established the fact that specimens of *R. pomonella* bred from apple are larger than those bred from blueberries (*Vaccinium* spp.), plants that are common in the eastern and northern parts of N. America, but absent from California, where, however, the smaller form of this fly is the one found. In Maine the small form of *R. pomonella* is bred from huckleberries, *Gaylussacia baccata*, which also are absent from California, being there represented by *Vaccinium ovatum* (Californian huckleberry). Though *R. pomonella* has been bred from haws, and though two species, *Crataegus rivularis* and *C. douglasi*, are found in California, yet the fact that individuals bred from these are practically of the same size as those bred from apple precludes the possibility of the *Crataegus* being the host-plant in California.

It has been suggested that the original host was a species of *Crataegus*, and that the species has spread on the one hand to the apple and related fruits, and on the other to the huckleberry and blueberry, in which an independent and quite different strain has arisen. Flies captured on apples refused to oviposit on blueberries, and half-grown larvae transferred from blueberries to different varieties of apple failed to develop.

LEES (A. H.). **The Raspberry and Loganberry Beetle** (*Byturus tomentosus.*)—*Ann. Rept. for 1917, Agric. & Hortic. Research Sta., Long Ashton, Bristol*, pp. 35–36. [Received 31st July

Byturus tomentosus (raspberry beetle) is a widely-
since the introduction of loganberry culture has show
preference for this fruit, that when it is grown with
latter remain comparatively free.

The insect hibernates as an adult in the soil under
appearing as soon as the weather becomes warm and
flowers immediately they open. As many as three
may be found in one flower, where, attracted by th
feed on the tissues of the base of the petals and stam
there. The young larvae burrow into the receptacle
fruit, causing a deformed growth; later they come
breaking the skin, which is then liable to attack by

Spraying with lead arsenate and ordinary cont
proved unsuccessful as a means of control, and th
shaking the flowers over pans filled with tree grease eff
of large numbers, it does not keep the fruit free in ba

Good results have been obtained by the experim
small scale of the following mixture:—Soft-soap 2
2 gals., nicotine ½ lb., water 100 gals. In practic
necessary to give a preliminary spraying to force th
their hiding places, and for this, the 2 per cent. pa
without nicotine was used. This double spraying
times during three weeks, and resulted in only 33 p
plants in the sprayed rows being infested, as agains
in the unsprayed rows.

De Ong (E. R.). **Dried Fruit Insects.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, vii, no. 6, June 1918, p. 429.

The insects most frequently attacking raisins, figs, prunes and other dried fruits during storage are :—*Plodia interpunctella* (Indian meal moth), *Ephestia cautella* (fig moth), *Silvanus surinamensis* (saw-toothed grain beetle) and *Carpophilus hemipterus* (dried fruit beetle). The eggs are laid on the fruit while drying or after packing, sun-dried materials beiug particularly liable to infestation. The larvae feed upon the fruit until they are mature, and breeding continues as long as favourable conditions of moisture and temperature exist, so that by late spring the value of infested products may he entirely destroyed.

To control these pests the usual methods must be employed, such as the preparatory thorough cleansing of storage rooms; the fumigation of infested rooms with gasoline or engine distillate; the careful sulphuring of fruit at the end of the drying season; the maintenance of a temperature of 150° F. for one hour throughout the entire mass of fruit, or when this is impracticable, the use of hydrocyanic acid gas or carbon bisulphide, the latter of which should always be used when the moisture content of the fruit is high.

Lees (A. H.). **Miscellaneous Notes on Plant Pests and their Treatment.** —*Ann. Rept. for 1916, Agric. & Hortic. Research Sta., Long Ashton, Bristol*, pp. 36–38. [Received 31st July 1918.]

The question of how late it is safe to spray with lime must be answered by the consideration of three points :—The time the pest hatches; the sticking power of the lime wash; the effect of the spray on the host-plant. The chief insects to be controlled by lime spraying are the apple-sucker [*Psylla mali*], and the rosy aphis [*A. kochi*] [see this *Review*, Ser. A, v, p. 173].

As regards the susceptibility of crops to wireworm damage, while no crop, with the possible exception of mustard, is immune, yet different crops vary in their susceptibility.

Very susceptible: Plants attacked at the fleshy collar and completely killed, dwarfed, or caused to go to seed prematurely : Onions, leeks, celery and lettuce.

Rather susceptible : Growth dwarfed, but plant not usually killed :—Runner beans, dwarf beans, and to a certain extent peas.

Slightly susceptihle :—The cabbage tribe and tomatoes.

Iujured, but not so as to endanger the life of the plant:—Potatoes, the injury as a rule being confined to the tuber.

Lees (A. H.). **Further Experiments on Big Bud Mite.**—*Ann. Rept. for 1917, Agric. & Hortic. Research Sta., Long Ashton, Bristol*, pp. 37–38. [Received 31st July 1918.]

The most successful spray tested during the winter of 1915–16 against the big bud mite [*Eriophyes ribis*] on black currant bushes proved to be that containing 10 per cent. soft-soap and 5 per cent. crude carbolic acid. One application in December was found to be insufficient, as the terminals and subterminals were often unaffected, though the buds situated low down on the shoot, being older and more loose in structure, were penetrated and the mites killed.

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In the following year, sprays were applied at three different times, viz. :—The beginning of December, the beginning of January, and the end of February; while other bushes received two applications, either the first and second or the first and third. The results showed the importance of the early spraying, and that the combination of the first and third sprayings was the best, though probably three would have given a better result than two. There was no decided result from the use of lime-sulphur.

The Breaking up of Grassland.—*Rothamsted Expt. Sta., Rept. for 1915–17, Harpenden,* 1918, pp. 9–12. [Received 27th July 1918.]

The breaking up of grass fields for crops has shown that the presence of hedges and trees, though it affords shelter to animals while the land is used for grazing, also affords shelter to sparrows and wood pigeons, which render the results of the growing of experimental crops valueless, while the hedgerow weeds support a number of injurious insects.

Another and more serious difficulty is the presence of wireworms in the soil, which has rendered the discovery of some suitable insecticide or method of soil treatment imperative. The problem of soil sterilisation has been under consideration for some time, it having been shown that if soil is treated with a volatile antiseptic there is a considerable gain in available nitrogen compounds and therefore an increase in productiveness. Toluene and carbon bisulphide have been very effective in pot experiments, but not in the field, where some of the tar acids, especially cresylic acid (the chief constituent of so-called "liquid carbolic acid") proved to be more suitable. Experiments have shown that carbon bisulphide, in quantities practicable on the farm, has no great insecticidal value. Efforts to put soil sterilisation methods into practice have shown that they are effective, but not economical, compared with the use of cheap ammonium sulphate or sodium nitrate. It would be quite a different matter however if a partial sterilisation agent could be found that was at the same time a soil insecticide, and with this end in view tests are being made with compounds of known constitution, and with certain typical waste products now available in quantity at a cheap rate.

The resistance of wireworms to certain poisons such as carbon bisulphide, toluene and formaldehyde, which ought to be effective but are not, is also being made the subject of study in the hope of gaining information that will be of service.

Since the most potent soil steriliser and larvicide is heat, attempts have been made to devise a means of heating soil cheaply on a large scale. A machine has been invented by means of which it is hoped that the pre-war cost of £40 per acre already attained by nurserymen in the Lea Valley, a figure not impossible for market-gardening and nursery work, may be still further reduced.

BRINDLEY (H. H.). **Notes on Certain Parasites, Food and Capture by Birds of the Common Earwig** (*Forficula auricularia*).—*Proc. Cambridge Phil. Soc.*, xix, July 1918, pp. 167–177.

The view held during recent years by various naturalists, that the dimorphism exhibited by the forceps of male earwigs is due to the

degree of infestation of the alimentary tract by Gregarines, is not borne out by the researches here described. Of several thousand individuals, over 50 males with forceps of varying length were dissected, with the result that the Gregarine, *Clepsydrina ovata*, was found to occur commonly and indifferently in all the specimens, which, moreover, showed no difference in the development of the testes or other internal sexual organs.

Several earwigs from the Scilly Islands were found to be parasitised by a Gordiid larva, the coils of which, though projecting between the tergites of the abdomen, seemed to have no effect on the health and activity of their hosts. Other individuals, though having the hind-gut partly or completely atrophied as the result of infestation, seemed active and healthy. The presence of *Filaria locustae* has been seen to have a more serious effect on the health of these insects [see this *Review*, Ser. A, v, p. 444].

Another species, *Forficula tomis*, Kol., is parasitised by the Tachinid fly, *Rhacodineura antiqua*, in Russia. *F. auricularia*, or perhaps *F. lesnei*, is said to be attacked by Acarid mites, and is also very susceptible to the attacks of fungoid parasites in the laboratory, *Entomophthora forficulae* frequently infesting it in the presence of damp.

In view of the diversity of reports as to the favourite food-plants of earwigs, and the general lack of knowledge of the amount of damage likely to be done by them in gardens, the author recently carried out a series of observations extending over some weeks. From these it seems certain that many ordinary garden plants are liable to serious attack by earwigs, which can thrive on a purely vegetable diet. It is not yet known, however, whether the choice of a particular plant in one locality and its neglect in another is due to the presence or absence of suitable animal food, or to differences in the preferences of nymphs and adults, the former being in the majority till about the end of July.

It seems certain that earwigs are often carnivorous by choice, and as there are records of their killing certain insect pests of plants, they may be regarded as, to some extent, beneficial insects. In short, the earwig has a reputation for evil that is only partly deserved, its nocturnal habits leading it to use the closely-packed florets of such flowers as the chrysanthemum and dahlia as day-time shelters from which nightly excursions for feeding may be made.

Wild birds cannot be relied upon to diminish the numbers of earwigs in a garden, as many of the most insectivorous do not appear to feed on them at all, though domestic fowls always eat them readily. They are also eaten by toads.

Contra la Langosta. [Against Locusts.]—*Rev. Inst. Agríc. Catalán S. Isidro, Barcelona*, lxvii, no. 13, 5th July 1918, p. 230.

A Royal Order, dated 25th June 1918, instructs the Governors of provinces that are threatened by locusts to take all measures required by law against these pests.

MASSINI (C. P.). **Instituto Biológico de la Sociedad Rural Argentina. Resúmen de lòs Trabajos efectuados durante el Año 1917.** [Summary of the Work done in 1917 at the Biological Institute of the Rural Society of Argentina.]—*Anales Soc. Rural Argentina, Buenos Aires*, lii, no. 3, March 1918, pp. 141–147. [Received 19th July 1918.]

A large part of the report of the Entomological Section deals with the biological control of injurious insects; the information regarding locusts and bagworms has already been abstracted [see this *Review*, Ser. A, v, pp. 505–506]. *Diloboderus abderus*, Sturm, a Scarabaeid with a destructive larva, is being studied. The orange pest, *Papilio troantiades*, Burm., was found to be attacked by a natural enemy and the method of utilising it has been worked out. Information has been collected regarding lucerne pests, of which the butterflies, *Colias lesbia* and *Tatochila autodice*, and the moth, *Rachiplusia nu*, Gn., are the chief. The last-named was found to be parasitised by a new Tachinid, *Plagia ayerzia*.

MASSINI (P. C.) & BRÈTHES (J.). **Tres nuevas Cochinillas argentinas y sus Parásitos.** [Three new Argentine Coccids and their Parasites.] —*Anales Soc. Rural Argentina, Buenos Aires*, lii, no. 3, March 1918, pp. 148–158, 10 figs., 8 plates. [Received 19th July 1918.]

The Coccids hitherto recorded from Argentina number about fifty only, and this is solely due to the fact that many species have not yet been studied.

The new species here described by Brèthes are *Pulvinaria platensis*, *P. flavescens* and *P. minuta*. None of these are injurious to any extent, because they are held in check by natural enemies, of which the following are here described by Brèthes:—*Tetrastichus caridei*, *Aphycus flavidulus* var. *caridei*, *A. flavidulus* var. *nigra*, *Onophilus caridei* and *Pseudaphelinus caridei*, the last two belonging to new genera. *O. caridei* appears to be the most efficacious of these enemies.

BRÈTHES (J.). **Quatre Hymenoptères Parasites du Chili.** [Four parasitic Hymenoptera from Chile.]—*Anales Zool. Aplicada, Santiago de Chile*, iv, no. 2, 31st July 1917, pp. 25–29, 4 figs. [Received 31st July 1918.]

This paper records the following parasitic Hymenoptera:—*Dasyphagus ancilla*, Wlk., a parasite of the eggs of the moths, *Dirphia amphimone* and *Macromphalia dedecora*, and the type-species of a new genus; *Aprostocerus vorax*, Wlk., a parasite of *M. dedecora*; *Calosoter silvai*, sp. n., parasitising the eggs of *M. dedecora*; and *Paridris chilensis*, gen. et sp. n., parasitising *D. amphimone*.

PORTER (C. E.). **Notas de Acarología. Un Parásito de la** *Schistocerca paranensis*, **Burm.** [Acarological Notes: A Parasite of *S. paranensis*.]—*Anales Zool. Aplicada, Santiago de Chile*, iv, no. 2, 31st July 1917, p. 30. [Received 31st July 1918.]

The Tarsonemid mite, *Podapolipus berlesei*, Lahille, is recorded from a specimen of *Schistocerca paranensis*, Burm., among the swarms of this locust present in Chile in January 1917 [see this *Review*, Ser. A, vi, p. 161].

Porter (C. E.). **Notas breves de Entomología agrícola.** [Brief Notes regarding Agricultural Entomology.]—*Anales Zool. Aplicada, Santiago de Chile*, iv, no. 2, 31st July 1917, pp. 33–37, 3 figs.

From material collected near Santiago, Chile, in 1913, three females of the Coccid, *Margarodes vitium*, Giard, hatched out in November 1916. The foliage of fuchsias cultivated near Temuco was severely injured by the Chrysomelid beetle, *Haltica virescens*, Bl. *Thrips tabaci* is recorded—for the first time in Chile—from onions, tobacco, potatoes, beet and ears of wheat: it may be expected to infest other plants and to become a pest if conditions favour it. In December 1916 peach trees near Santiago were severely attacked by the Curculionid, *Lophotus phaleratus*, Er. In March 1917 carobs at Limache were badly infested by *Bruchus pisorum*, L. The Chalcid, *Aspidiotiphagus citrinus*, Craw, was observed parasitising the scale, *Fagisuga triloba*, Lindgr., infesting *Saxegothea conspicua* and *Notophagus dombeyi*. The latter plant was found also to be a host of *Pseudoparlatoria chilina*, Lindgr., which up to then had been known from *Saxegothea conspicua* only.

Porter (C. E.). **Sobre el Régimen de algunos Artrópodos de Importancia económica.** [On the Food of some Arthropods of Economic Importance.]—*Anales Zool. Aplicada, Santiago de Chile*, iv, no. 2, 31st July 1918, pp. 37–38. [Received 31st July 1918.]

Pseudococcus adonidum was abundant in and around Santiago in 1916. This scale is preyed upon by *Coccinella fulvipennis* and *Scymnus (Parasidis) macula*, Germ. In the same district *Chrysopa porterina*, Navás, preys upon *Eriosoma lanigerum* with avidity.

Lécaillon (A.). **Sur l'Apparition des Papillons de la Piéride du Chou (*Pieris brassicae*, L.) au Printemps.** [On the Emergence of the Adults of *Pieris brassicae* in the Spring.]—*Bull. Soc. Étude Vulg. Zool. Agric., Bordeaux*, xvii, no, 7, July 1918, pp. 65–67.

Pieris brassicae, L. (cabbage butterfly) can be easily destroyed at any stage of its development. The netting of the adults when they come to oviposit on cabbages is a method of control too slow to be practicable, but the use of poison-baits should be a means of destroying large numbers during the many months of the year in which they are on the wing. With a view to testing the usefulness of this method, researches were conducted to discover the time elapsing between emergence and oviposition. It was found that the dates on which these spring butterflies emerge has no direct connection with the age of the autumn pupae that give rise to them, while the eggs they contain are far from being completely developed.

Sharples (A.). **The Laticiferous System of *Hevea brasiliensis* and its Protective Function.**—*Annals of Botany, London*, xxxii, no. 126, April 1918, pp. 247–251.

The general opinion obtaining among rubber planters in the Middle East is that small boring-beetles, such as the Scolytid, *Xyleborus parvulus*, and the Longicorn, *Pterolophia melanura*, are unable to

penetrate the bark of a healthy rubber tree without being killed by the latex, and that it is only when the laticiferous cells have been previously killed by fungal hyphae, that they are able to reach the wood.

Fickendy's method of tapping *Hevea brasiliensis*, which produces a 50 per cent. increased yield of latex by scraping the bark of the proposed tapping area some time previous to tapping, has been found to induce attacks by *Xyleborus parvulus*, and it has been experimentally proved that it is the corky integument, and not the laticiferous layer, that is the important protection against insect and fungus attacks. When this is removed, the susceptibility of the trees to attack is greatest, being less when the green cork-cambium is left intact. The rapidity of the insect attack under these circumstances is striking, borers being active within four days of the treatment of the tree.

The removal or injury of the cortical layers by fire after a spell of dry weather has similar results, borers quickly attacking scorched trees and causing the exudation of the latex in streams. This however does not prevent the insects reaching the wood, though many may be caught in the liquid.

DALLIMORE (W.). **Wood Preservation.**—*Bull. Miscell. Inform. Roy. Bot. Gdns., Kew, London*, 1918, no. 5, pp. 181–189.

In order to preserve wood against the attacks of insects and marine borers, it is necessary to make it poisonous to animal life, or to render it objectionable in some other way. Highly scented woods are, as a rule, less subject to injury by insects than unscented ones, and good results have been obtained by dressing the latter with cedar oil. Most of the substances used to protect wood from fungus attacks also render it poisonous to insects, and the thorough impregnation of piles and wharf timbers with heavy tar oils is the best means of preserving it from the attacks of marine borers.

Decay in furniture and other woodwork caused by the larvae of beetles and other insects may be checked or stopped by killing the larvae *in situ*. This may be done by heating the timber, or by soaking it in a solution of carbolic acid or corrosive sublimate, or by exposing it to the fumes of carbon bisulphide in a closed room. Good results may also be obtained by applying the latter liquid with a painter's brush, so as to fill up all the holes. Carbon tetrachloride mixed with a little cedar oil or naphthaline may also be used with satisfactory results, but all these substances destroy the polish when applied to polished wood.

In some tropical countries bamboos used in a natural state are soon ruined by beetles, but in India they are found to be immune to attack after being thoroughly soaked in water.

EDWARDS (J.). ***Psylla sorbi*, L., in Britain.**—*Entomologists' Mthly. Mag., London*, liv, no. 648, May 1918, pp. 113–114.

The identity of the Psyllid on mountain ash, recorded by Linnaeus as *Psylla (Chermes) sorbi*, having been in doubt, the author reports having found this species at Northwich in 1910 and 1911 on mountain ash. A description is given, showing the points of difference between it and *P. mali*.

MUIR (F.). **Pipunculidae and Stylopidae in Homoptera.**—*Entomologists' Mthly. Mag., London,* liv, no. 649, June 1918, p. 137.

DELPHACIDAE collected on grass in Scotland have proved to be parasitised to the extent of 30 per cent. by *Stylops* sp., the same genus collected in the Hawaiian islands frequently showing parasitisation with attendant abortion of the genitalia. In the Philippines, Java and the Malayan islands, Jassids and Fulgorids parasitised by *Stylops* are not uncommon, and it is probable that investigation would show parasitic PIPUNCULIDAE and STYLOPIDAE to be common among British Homoptera.

GRIMSHAW (P. H.). ***Chortophila pilipyga*, Villeneuve, in Britain.**—*Entomologists' Mthly. Mag., London,* liv, no. 650, July 1918, pp. 156–157.

Phorbia (*Chortophila*) *pilipyga*, a species recently described from France, is now recorded from Nottingham. A description is given, distinguishing it from the very similar *P.* (*C.*) *brassicae*, Bch.

NEWBERY (E. A.). ***Lophocateres pusillus*, Klug, a cosmopolitan Beetle, in London.**—*Entomologists' Mthly. Mag., London,* liv, no. 650, July 1918, pp. 162–163.

Lophocateres pusillus, a beetle not previously found in Britain, is recorded as infesting butter beans together with *Lasioderma serricorne*, F., and *Tribolium navale*, F.

MORLEY (C.). **Parasites of the Hawthorn *Trichiosoma*.**—*Entomologists' Mthly. Mag., London,* liv, no. 650, July 1918, pp. 163–164.

The Ichneumonid, *Pimpla instigator*, F., a common parasite of Lepidoptera, has also been recorded from *Pteronus salicis*, L., and *P. dimidiatus*, Lep. It is now reported from the cocoon of another sawfly, *Trichiosoma tibiale*, in which was also a single male of the gregarious Cryptid, *Panargyrops claviger*, Tasch., an uncommon species known to attack the sawflies, *Diprion* (*Lophyrus*) *pini* and *Emphytus cinctus*.

MORLEY (C.). ***Donacia clavipes*, F. at Home.**—*Entomologists' Mthly. Mag., London,* liv, no. 651, August 1918, p. 183.

The Chrysomelid, *Donacia clavipes*, is recorded from the base of the rolled-up leaf of the reed, *Phragmites communis*. A colony of *Hyalopterus arundinis*, F., was present on the stem and the beetles were detected in some cases in the act of devouring the Aphids or their honeydew.

COPLEY (G. H.). **Some Garden Pests.**—*Gardeners' Chronicle, London,* lxiii, no. 1643, 22nd June 1918, pp. 253–254, 2 figs.

In the Bradford district of Yorkshire, insect pests were extremely abundant in the summer of 1918, especially *Tipula oleracea*, the larva of which attacked cabbages, peas and beans, cutting through the stem, either upon, or just beneath, the surface of the soil. Oviposition takes

place in the autumn, the larvae emerging about a fortnight later, but not beginning to feed till the first warm days of spring. Preventive and remedial measures should take the form of the thorough drainage of grass-land and the cleansing of water-courses, while the stimulation of an affected crop by the application of sodium nitrate or ammonium sulphate may often more than repair the damage due to this pest.

Hylemyia antiqua (*Anthomyia ceparum*) (onion fly) was also very destructive, ovipositing upon the neck of the bulb in late April and May. The eggs hatch quickly and the larvae eat the tissues of the bulb and pupate. As the flies emerge in about 3 weeks there may sometimes be three generations a year in the south of England. The pest hibernates in the ground in the pupal stage, and consequently onions should not be grown on infected land for some years. A dressing of soot applied to the onion crop about the time the flies appear serves the double purpose of repelling them by its odour and stimulating the growth of the plants.

Attacks of Aphids and red spider should be dealt with in their initial stages by spraying with a solution composed of soft soap 1 lb., quassia extract 1 lb., water 20 gals.

Pear Tree Slug Worm.—*Gardeners' Chronicle, London*, lxiv, no. 1650, 10th August 1918, p. 64.

Eriocampoides annulipes, Klug (*Selandria atra*, Steph.) (pear-tree sawfly) is a very common pest in some districts in England, attacking cherry leaves as well as pear foliage. The eggs are laid just below the upper surface of the leaves at the end of May or during June, the larvae appearing shortly afterwards. They may be destroyed by two or three applications of quicklime, at intervals of a day or two, or infested trees may be sprayed with a solution of 2 lb. soft soap and 1 peck lime in 30 gals. water. These larvae moult after about 6 weeks and enter the ground to pupate, hibernating in their cocoons till early the following summer. Hence a method of control which confers a double benefit lies in removing the soil under the trees, to a depth of about 4 inches, and replacing it with a similar amount of clean rich soil.

Girault (A. A.). **A New Species of *Lepidiota* from Northern Queensland.**—*Entomologist, London*, li, no. 663, August 1918, p. 183.

This note describes *Lepidiota consobrina*, sp. n., being one of the undetermined species of these sugar-cane pests previously recorded from Queensland [see this *Review*, Ser. A, vi, p. 166].

Roberts (A. W. R.). **Turnip Flea-beetles—Wireworms.**—*Entomologist, London*, li, no. 663, August 1918, p. 187.

Phyllotreta nemorum, L., does not appear to be a common turnip pest in the Harpenden district, Hertfordshire, *P. undulata*, Kutsch., and *P. vittula*, Redt., being the flea-beetles usually found on turnips, both there and in Westmoreland.

Agriotes lineatus, L., is frequently referred to as one of the common wireworms, but in Hertfordshire, Cheshire, North Staffordshire, South Lancashire and Westmoreland, *A. obscurus*, L., is the most

abundant species, *A. sputator*, L., being also recorded from the same districts, with the exception of Westmoreland. *A. sobrinus*, Kiesenw., and *A. pallidulus*, Illig., though not likely to be classed among the dangerous pests, may be found fairly commonly in Hertfordshire by sweeping the early umbelliferous flowers.

METCALF (M. M.). **Poisoning Tree Parasites with Cyanide of Potassium.** —*Science, Lancaster Pa.*, xlvii, no. 1214, 5th April 1918, pp. 344–345.

The method of killing insect pests of fruit trees by placing potassium cyanide under the bark having been stated to cause the death of the tree within two or three years, the author has made experiments on these lines on scale-infested apple and pear trees. In each of six trees half-inch holes were bored, which were filled with chemically pure potassium cyanide and then plugged up. Four of these trees were apparently dying, but during the summer they began to recuperate and all six became free from scale, and have continued healthy and vigorous during the ensuing three years.

The effectiveness of the treatment as a pest exterminant, however, remains doubtful, as during the same season the scale disappeared from other infested, but untreated trees.

HOWARD (L. O.). **The Contribution of Zoology to Human Welfare.**—*Science, Lancaster, Pa.*, xlvii, no. 1215, 12th April 1918, pp. 349–354.

It has been computed that the entomologists of the United States Department of Agriculture have contributed as their share towards the welfare of humanity an annual saving to the country of £100,000,000, by the introduction and continual improvement of remedies against insect pests attacking growing and stored crops.

Those working in the equally important field of medical zoology are now beginning to receive more and more consideration from sanitarians.

BENEDICT (R. C.). **The Yellow Clothes Moth.**—*Science, Lancaster, Pa.*, xlvii, no. 1216, 19th April 1918, p. 392.

Since the publication of a previous paper on the yellow clothes moth [*Tineola biselliella*] [see this *Review*, Ser. A, vi, p. 48] the author finds that the fact that the first brood of each year is mainly derived from eggs of the preceding year had already been recorded by Professor Herrick.

Although the moths may emerge in every month of the year, there are two periods of special abundance, the first from the end of April to the end of June, and the second from late August to the end of September. The actual life-cycles occupy approximately 3½ months (June to 15th September), and 8½ months (15th September to June).

TURNER (W. F.). *Nezara viridula* **and Kernel Spot of Pecan.**—*Science, Lancaster, Pa.*, xlvii, no. 1220, 17th May 1918, pp. 490–491.

Nezara viridula, L. (green soldier bug) is of common annual occurrence throughout middle and southern Georgia and in some

years becomes exceedingly numerous. Its favourite host-plant is the cowpea, either cultivated or wild, on the drying-up of which in the autumn, it migrates to any other plants or trees in the vicinity.

The fact that the cowpea is frequently grown in pecan groves in the early summer as a manurial crop, and that bad outbreaks of the kernel spot disease of pecan due to the fungus, *Coniothyrium caryogenum*, coincide with the occurrence of *N. viridula* in unusual numbers, has led to investigations being made on the probable connection between the disease and the insect. The data obtained from the preliminary experiments are strongly indicative of the fact that this bug is an important agent in either the actual production or the dissemination of the disease.

CHAPMAN (R. N.). **Measures for Protecting Wheat-flour Substitutes from Insects.**—*Science, Lancaster, Pa.*, xlvii, no. 1224, 14th June 1918, pp. 579–581.

In order to heat cereals so as to kill any stages of insects that they may contain, a temperature well above 113° F. at 24 per cent. of relative humidity, and below 201° F., is required. This may be effected by placing the cereal in pans about 2 in. deep and heating it in an oven till the temperature on the surface reaches 185° F. In the case of gas or oil ovens, the fire should then be turned out and the cereal left in the closed oven for 45 minutes, but with a coal or wood stove, the door should be opened and the fire kept low during the same time. For household use, a wax melting at 185° F. is now sold in small pieces, one of which should be placed on a sheet of paper on the top of the cereal, the supply of heat being cut off when this liquifies.

SPEYER (E. R.). **Progress Report on Investigations into Shot-hole Borer of Tea.**—*Trop. Agriculturist, Peradeniya*, l, no. 6, June 1918, pp. 373–374.

Further investigations in Ceylon on the shot-hole borer of tea [*Xyleborus fornicatus*] have shown that development at an elevation of 1,600 ft. is more rapid by some 3 weeks than that at 4,300 ft. Observation on the fungi upon which the larvae of *X. fornicatus* feed, and which have been identified as *Monacrosporium* and a conidial *Ambrosia* (though there is a remote possibility that the former may be a free living stage of the latter), have led to the conclusion that economic control by the destruction of this fungus in the galleries is impracticable.

Experiments on the burying of prunings at a depth of from 2 to 5 inches with the addition of ½ lb. quicklime (stone), ½ lb. slaked lime (powdered), 2 oz. ammonium sulphate, or 2 oz. calcium phosphate (powdered), respectively, showed that by the end of two months a certain number of the galleries heal over, causing in some cases the death of the insects, and that this process is increased by rain, by calcium phosphate and to a less extent by powdered slaked lime, but not by unslaked lime or by ammonium sulphate.

Experiments with paints showed that a coconut-oil soap-emulsion could not be used on the bushes even in the most dilute solutions, owing to its harmful effects. The use of fish-oil, emulsified with Ceylon soap and resin, seems likely to be a success, and it may be

possible to make the mixture still cheaper by the substitution of liquid fuel for fish-oil. A mixture of resin and Ceylon soap, suitably diluted, is proving of great value as an insecticide for scale-insects and Aphids, being cheap, easily made and less caustic than the contact poisons in general use; though against *X. fornicatus* its use can be recommended as a preventive measure only.

JARDINE (N. K.). **Additional Facts regarding Tea Tortrix.**—*Trop. Agriculturist, Peradeniya*, l, no. 6, June 1918, pp. 375–376.

The life-history of the tea tortrix [*Homona coffearia*] has now been worked out in detail. The average length of the various periods proves to be 10 days for the egg-stage, 4 to 5 weeks for the larval, 1 week for the pupal, and 1 week of adult life, the whole cycle thus requiring 6 to 8 weeks. At 4,000 ft. altitude the chief difference in the life-history is in the egg-stage, this period being longer by 1 to 3 days. During times of particularly low temperature at high elevations the development of the larvae may also be considerably delayed.

It has frequently been noticed that a sudden appearance of the pest has occurred in the centre of a field that was free from it a few days before. Investigation has shown that in such cases the insect can generally be found infesting such shade-trees as *Grevillea*, *Acacia*, *Albizzia* or dadap in close proximity, on which it has propagated and then, through overcrowding or lack of food, has dropped on to the tea. As regards the loss of crops due to this pest, tea to the value of £5,040 has been destroyed on 3,150 acres.

WARBURTON (C.). **Annual Report of the Zoologist for 1917.**—*Jl. R. Agric. Soc. England, London*, lxxviii, 1917, pp. 209–219. [Received 7th August 1918.]

Forest trees were attacked during the year by pests, such as beech coccus [*Cryptococcus fagi*] and pine-shoot tortrix [*Rhyacionia buoliana*], but the most important and unusual case was the damage to holly trees in Derbyshire by the larvae of a small moth, *Rhopobota* (*Grapholitha*) *naevana*, which attacked the terminal shoots and buds, disfiguring and almost destroying exceptionally fine trees. A severe pruning of the trees in June before the hatching of the new brood, followed by the burning of all fallen leaves and rubbish beneath them, if persisted in for two or three years, should result in the extermination of this pest.

Cereals were attacked by frit fly [*Oscinella frit*], which appeared in oats owing to late sowing on account of the weather, beneficial results however being obtained from an early dressing of sodium nitrate. Wireworms were very destructive to oats in districts where the tilth was good, the only good growth occurring on patches where the soil had been consolidated by the pressure of stacks or traction engines. Barley succeeds better than oats in infested land, owing to its more rapid germination.

Peas and beans were attacked by all the usual pests, but the *Sitones* weevil was injurious to an unprecedented extent. The most effective remedial measure was a heavy dressing of soot. *Acidia*

heraclei (celery-fly) was another common pest very troublesome in gardens and allotments, attacking the leaves of celery, parsnips, and parsley. The attacks may be controlled by the removal and burning of any leaves showing developing blisters. Examination of the larvae at the end of October showed that nearly all were parasitised by a Chalcid.

Two fruit pests of increasing importance have been investigated during the year, namely *Plesiocoris rugicollis* (apple Capsid bug), which, however, was held in check by two sprayings of nicotine and soft-soap, and the strawberry moth [*Oxygrapha comariana*, Z.], the eggs of which, laid on the stipules, resemble those of the codling moth [*Cydia pomonella*]. A case of a serious infestation of plum trees in a well kept orchard at Evesham, believed to be due to a shot-hole borer beetle, was investigated in August, when traces of *Scolytus rugulosus* were found on many of the trees, and the borings of *Xyleborus dispar* were discovered low down in the trunk of a dying tree that had been cut down. The best measures against the latter beetle include the cutting down and burning of all hopelessly infested plum trees early in September, when the number of beetles reaches a maximum; the examination of hedges and forest trees in the neighbourhood of gardens, and the avoidance of the use of unbarked orchard props; the application, early in March, of a repellent dressing to the trees in the form of a stiff paste by means of a brush, the mixtures recommended being clay and lime, soft-soap and washing soda, soft-soap with a trace of carbolic acid, and clay with lead arsenate, though the last should never be used if stock is grazed in the orchard; the use of trap-trees is advocated, for which purpose the stumps left in the ground from the previous September might be used, or oak or hawthorn stakes, newly-cut, should be driven into the ground among the plum trees, then removed and burned by June, when the eggs begin to hatch. *Scolytus rugulosus* (fruit bark-beetle) is a smaller insect than *X. dispar*, and the damage due to it, which occurs in the bark, does not prove so rapidly fatal. The spring attack begins in April or May and is at its height in June, a new brood reaching maturity in August. A third brood may appear in October, but this is probably dependent on the weather to some extent. The general methods of treatment recommended against *X. dispar* may be adopted, but the danger of woodstacks containing plum or apple branches must be guarded against, as *S. rugulosus* breeds in dry felled timber, while *X. dispar* requires it to be full of sap. Oak stakes are useless as traps for *S. rugulosus*, as it does not attack this tree.

The reappearance of *Charaeas graminis* (antler moth) in hill pastures during the summer of 1917, was found to be of comparatively little importance, since no good meadow grass or crops were attacked, but only upland pastures at an altitute of 750 ft. and over. The special causes leading to the outbreak were :—The scarcity of birds, especially the lapwing; the severe winter without the usual mild spells; and the regulations forbidding the burning of moorlands and mountain grass areas [see also this *Review*, Ser. A, v, pp. 478, 481]. Six previous outbreaks of this pest have been recorded in Great Britain during the past century, two of them having occurred in Cumberland.

GLASER (R. W.). **On the Existence of Immunity Principles in Insects.**—*Psyche, Boston, Mass.*, xxv, no. 3, June 1918, pp. 39–46.

The author's summary of this paper is an follows:—Entomological text-books emphasise the importance of phagocytosis in ridding the insect body of foreign matter, but in reality insect blood cells are visibly rather passive, those of the grasshopper, *Melanoplus femur-rubrum*, and army worm caterpillar [*Cirphis unipuncta*] not seeming to phagocytise bacteria in an amoeboid fashion. When bacteria are found within the blood cells, they may have gained entrance through their own agression, or physical factors may have been involved. The blood of normal insects, however, is somewhat antagonistic towards bacteria, this antagonism acting extra-cellularly. Actively immunised grasshopper blood shows a high degree of antagonism towards the bacteria used in producing this immunity. An agglutinin was found in immune grasshopper blood and some quantitative data on the bactericidal action of immune grasshopper blood were obtained

WEISS (H. B.) & DICKERSON (E. L.). **Notes on *Trioza alacris*, Flor, in New Jersey.**—*Psyche, Boston, Mass.*, xxv, no. 3, June 1918, pp. 59–63.

Trioza alacris, Flor (*lauri*, Targ.) is a well known and destructive Psyllid in Europe. It was introduced into New Jersey from Belgium and attacks bay trees (*Laurus nobilis*) that are kept out of doors all the year round or during the summer. Infested trees have a sickly appearance, the leaves—usually those at the tips of the branches—being curled, discoloured and blistered, and containing whitish masses composed of the nymphs clothed in a white, waxy secretion. The pest hibernates as an adult on bay trees kept in houses where the temperature never falls below 38° or 40° F. About the middle or end of May the trees are moved out of doors and oviposition then begins. The eggs are laid on the under-sides of young leaves near the margins, from 25 to 200 occurring in a single irregular cluster, and the leaves then become rolled in tightly towards the midrib. Adults of the first brood appear about the middle of July, six weeks being required for a complete life-cycle. Those of the second brood can be found about the first of September and these continue to appear for another month or so.

It is impossible to reach the nymphs in the curled leaves with contact insecticides, but almost complete destruction was secured in one case by fumigating with tobacco smoke while the trees were in storage and heavily infested by overwintering adults. Hand-picking of curled infested leaves has been resorted to, but the process is too slow to be practicable on a large scale.

LOMBARDI (L. P.). **Can the Action of Cold decrease Mortality among Silkworms suffering from "Flacherie"?**—*Informazioni Seriche, Rome*, v, no. 2, 20th January 1918, pp. 19–20. (Abstract in *Mthly. Bull. Agric. Intell. & Pl. Dis., Rome*, ix, no. 6, June 1918, p. 728.)

The statement has been made that the mortality among silkworms suffering from flacherie can be stopped by exposing them to a

temperature of 54° F. for 48 hours without food, a treatment that induces them to spin their cocoons. Experiments however show that their condition is not permanently improved by this treatment, and that the disease is only temporarily arrested, to regain its virulence later.

FUJIMA (D.). **On the Discovery of a Plant Suitable for Feeding Silkworms.**—*Bulletin de l'Association Séricicole du Japon, Tokyo*, ii, no. 12, 25th December 1917, pp. 1–16. (Abstract in *Mthly. Bull. Agric. Intell. & Pl. Dis., Rome*, ix, no. 6, June 1918, pp. 728–729.)

Since it is not unusual for young mulberry leaves in Japan to suffer from drought and frost, search has been made for frost-resisting plants suitable for feeding silkworms, in addition to *Cudrania triloba* (silkworm thorn) and *Broussonetia kazinoki*, which are already known to be useful for the purpose.

It has been found that *Lactuca brevirostris* is perfectly suitab c, the plant starting to grow early in spring and reaching a height of 6 or 7 ft. by the autumn. If cut in summer, it rapidly produces shoots, so that the leaves can be used continuously from spring to autumn. Silkworms fed on these until the second moult gave better results than those on mulberry, the results being only slightly inferior with those fed in this way up to the third moult.

ZANON (V.). *Dictyothrips aegyptiacus*, **a Thysanopteron injurious to the "Black Morocco" Variety of Vine, in Cyrenaica.** —*L'Agricultura Coloniale, Florence*, xi, 2nd half-year, no. 6, 1917, pp. 394–397, 2 plates. (Abstract in *Mthly. Bull. Agric. Intell. & Pl. Dis., Rome*, ix, no. 6, June 1918, p. 773.)

During 1916 and 1917 *Dictyothrips aegyptiacus*, Marchal, was found to be present in Cyrenaica almost exclusively on the "black Morocco" variety of vine, which was grown on a trellis and was suffering somewhat from drought.

This thrips not only soils the foliage with its excreta, but causes the formation of discoloured areas on the leaves, with subsequent withering. Notes on the morphology and life-history are given.

MELANDER (A. L.). **Spraying Formulas for Garden and Orchard Insects.** —*Washington State Coll., Pullman.* Extension Service, Series 1, no. 35, January 1918, 16 pp., 9 figs.; and no. 39, March 1918, 16 pp., 10 figs. [Received 8th August 1918.]

These pamphlets deal with the biting and sucking insects commonly attacking garden crops and orchards, and give formulae for the usual poison solutions, together with practical instructions for spraying and fumigation.

SAUNDERS (J. G.). **Prevent Grain Losses by Early Threshing.**—*Wkly. Press Bull. Pennsylvania Dept. Agric., Harrisburg*, iii, no. 30, 25th July 1918.

Attention is drawn to the fact that the heavy loss, amounting to £200,000 in eastern Pennsylvania, due to damage in stored grain by the Angoumois grain moth [*Sitotroga cerealella*] may be prevented

by immediate or early threshing. Unthreshed grain in storage furnishes ideal conditions of heat and moisture for this pest, which may produce annually as many as eight generations.

TREHERNE (R. C.). **The Control of Insects in Ships by Steam.**—*Agric. Gaz. Canada, Ottawa*, v. no. 7, July 1918, pp. 668–669.

The case is cited of a small coasting steam-vessel conveying a cargo of rice from Seattle to Vancouver, which on arrival was found to be heavily infested with *Calandra oryzae* (rice weevil). As it was desired to reload with a cargo of flour, it was necessary to disinfect the hold, where enormous numbers of the weevil were still present. Accordingly an all-night sulphur fumigation was undertaken, 20 lb. sulphur being burned in an iron carrier in the hold, which was 43 ft. long, 18 ft. wide and 8 ft. deep. Next day, after opening and airing the hold it was found that only part of the weevils had been destroyed, and a further treatment with superheated steam was decided upon. One of the steam pipes was accordingly disconnected and turned inwards, the hold was battened down and the upper deck was washed down with boiling water. On examination of the vessel after 5 hours of this treatment, with a temperature of 200° F. within the hold, no living weevils were visible, but 12 hours later the weevils began to reappear from the bilges whither they had retreated and to which the heat had not penetrated. A third attempt was therefore made, the bilges being flooded and the hold superheated as before; the result was eminently satisfactory, all trace of weevil infestation being destroyed.

Before the method can be recommended for a cargo-laden hold, a fuller knowledge of the effects of wet and dry heat on dried stored products and grain is necessary. As regards rice, at any rate, the treatment with heat is a dangerous practice, since superheated rice becomes useless for milling.

JACK (R. W.). **Notes on Remedies for Turnip Sawfly** (*Athalia flacca*, Konow).—*Rhodesia Agric. Jl., Salisbury*, xv, no. 3, p. 279.

The earlier experiments with arsenical compounds in the form of dust against *Athalia flacca* were made during the wet season, when the pest is most injurious, and failed, owing to the applications being immediately washed away.

During the wet season of 1917–18, *A. flacca* was very prevalent in Southern Rhodesia, and was recorded for the first time at Salisbury. It continued its ravages after the cessation of the rains, which allowed of the application—by means of sulphur bellows—of a dry mixture consisting of Paris green 1 lb. and slaked lime 20 lb.; sixteen hours later, large numbers of the insect were found dead on the ground, showing that the treatment can be recommended as highly effective, if an interval of this duration without rain elapses after the application. The mixture is, moreover, cheaper than paraffin emulsion, is not in any way injurious to the plants, and is more effective on the larger ones.

Jamieson (G. S.). **The Determination of Arsenic in Insecticides by Potassium Iodate.**—*Jl. Indus. Engin. Chem.*, [*sine loco*], x, no. 4, 1918, pp. 290–292. (Abstract in *U. S. Dept. Agric. Expt. Sta. Record, Washington, D.C.*, xxxviii, no. 9, 9th August 1918, pp. 804–805.)

The iodate titration method has been applied to determine the total arsenic in arsenical insecticides or fungicides, and the results have been compared with those obtained by the official iodimetric method. The method is described in detail, with data as to the determination of arsenic in several samples of Paris green and zinc arsenite. The results of the test analyses agree closely with those obtained by the official method. This accurate method is said to be not only quicker, but simpler. The very definite and remarkably sharp end-point, the great stability of the potassium iodate solution, and the readiness with which it can be prepared, all indicate its usefulness in place of the iodimetric procedure.

Dickerson (E. L.) & Weiss (H. B.). *Popilia japonica*, **Newm., a recently introduced Japanese Pest.**—*Canadian Entomologist, London, Ont.*, l. no. 7, July 1918, pp. 217–221, 1 fig.

A Scarabaeid beetle, which has been identified as *Popilia japonica*, Newm., was observed in southern New Jersey in August 1916, feeding on the tips of *Crataegus*. Upon further examination, the beetles were found to be abundant on weeds such as *Polygonum virginianum* (smartweed), *Tiniaria arifolium* (tear-thumb), both belonging to the Polygonaceae, as well as *Ampelopsis quinquefolia* (Virginia creeper) and other weeds. In many cases the leaves were completely riddled by the beetles. As the insect attacks Polygonaceae, it is feared that it might, if allowed to spread, become a serious pest of such plants as buckwheat, while its preference for Vitaceae constitutes a menace to grapes. In Japan, the food-plants are string beans, peas, grapes and peanuts, the larvae being found in the soil on the roots. The larva winters in the soil and pupates in May or June, the beetles emerging in July. Eggs are deposited singly in the soil and the larvae moult several times before winter, the complete life-cycle occupying one year. Remedial measures include jarring the beetles into a dish of oil and water, and spraying with Paris green, lime and water or Paris green and Bordeaux mixture, and by the use of Vaporite in the soil. In New Jersey, infested weeds and nursery plants are being treated with arsenic supplemented by hand-picking.

Ferris (G. F.). **Notes on Coccidae (Hemiptera).**—*Canadian Entomologist. London, Ont.*, l, no. 7, July 1918, pp. 221–225, 1 plate.

This paper redescribes *Cryptokermes brasiliensis*, Hempel, recorded from *Mimosa* in Mexico.

Braun (A. F.). **New Species of Microlepidoptera.**—*Canadian Entomologist, London, Ont.*, l. no. 7, July 1918, pp. 229-236.

Among the species here described are: *Erineda aenea*, sp. n., the larvae of which feed in September on the ferns, *Asplenium angustifolium* and *A. acrostichoides*, in Ohio, their time of reaching maturity

being dependent upon the time of spore production in the ferns; *Swammerdamia cuprescens*, sp. n., bred from larvae in webs on birch (*Betula glandulosa*) in British Columbia; *Acrocercops affinis*, sp. n., bred from blotch mines on oak, both deciduous and evergreen, in California; *Parornix (Ornix) spiraefoliella*, sp. n., mining the underside of leaves of *Spiraea* sp. in British Columbia; *Gracilaria hypericella*, sp. n., reared from larvae on *Hypericum cistifolium* and *H. punctatum* in Ohio; and *G. ferruginella*, sp. n., reared from larvae on *Azalea* and *Rhododendron occidentale* in California.

GILLETTE (C. P.). **The Black Cherry Aphis,** *Myzus cerasi.—Canadian Entomologist, London, Ont.*, l, no. 7, July 1918, p. 241.

It is pointed out that although *Myzus cerasi* has been treated as a species not having alternate food-plants, it has since been observed upon watercress as well as upon the cherry. There is evidence, however, that this Aphid continues throughout the year upon the cherry in Colorado, and has never been found abundantly upon the alternate host.

GARNETT (R. T.). **An Annotated List of the Cerambycidae of California.** —*Canadian Entomologist, London, Ont.*, l, no. 7, July 1918, pp. 248–252.

This list of Californian Cerambycids, which is a continuation of previous instalments [see this *Review*, Ser. A, vi, pp. 363, 396], includes, among other species of economic importance:—*Leptura obliterata*, Hald., which breeds in Douglas spruce, redwood and other coniferous trees; *L. soror*, Lec., found in branches of *Pinus ponderosa*; *L. propinqua*, Bland., breeding in conifers; *L. sexmaculata*, L., breeding in spruce; *L. brevicornis*, Lec., breeding in *Pinus ponderosa*; *L. crassipes*, Lec., bred from *Umbellularia californica* and *Eucalyptus globulus*; and *L. insignis*, Fall., breeding in Monterey pine.

LEMÉE (M. E.). **Dégats causés dans les Jardins de la Région d'Alençon par les principaux Ennemis des Plantes potagères et des Arbres fruitiers.** [Damage caused in the Gardens in the Region of Alençon by the Principal Enemies of Vegetables and Fruit-trees.] —*Jl. Soc. Nat. Hortic. France, Paris*, xix, March-April-May 1918; pp. 42–48, 61–64, 74–76. [Received 13th August 1918.]

Crioceris merdigera occurred in considerable numbers as an accidental pest of onions and chives at Alençon, the larvae devouring the tips of the leaves. Carrots sown in the spring were badly attacked by red spider. Winter cabbages having been killed by frosts, more resistant plants were imported; the majority of these bore round galls on the stems containing larvae of a weevil, *Ceuthorrhynchus brassicae*, and the plants so attacked gave very poor results. *Pegomyia hyoscyami* (beet fly) lives in the larval stage in the parenchyma of the leaves, producing large discoloured patches and causing decay of the foliage. The leaves should be cut and burnt as soon as they are attacked, while the larvae are still within them. Leeks were

attacked by the larvae of *Acrolepia assectella* (*Tinea alliella*), a small moth that oviposits on the central leaves, the larvae mining down to the heart of the plant and causing its death. Soot should be sprinkled as a repellent on the young plants; spraying with a 3 per cent. black soap solution is also recommended. Infested plants should be cut below the gallery which the larva has constructed, and the infested parts burned; the plants should then be hoed and manured in order to accelerate growth.

The Aphids, *Aphis pyrastri* and *A. pyri*, appeared in great numbers on the leaves and the ends of young shoots of pears, causing considerable damage. Pear trees have also been attacked by the larvae of *Eriocampoides limacina* (*Tenthredo adumbrata*), which are abundant in September and October, living in the parenchyma of the leaves. As the attacks occur when the fruit is half-grown, the damage done is considerable. To destroy the larvae, the leaves should be dusted with powdered fat lime. *Eriophyes* (*Phytoptus*) *pyri* punctures the leaves, causing blisters. As winter approaches, these small Acarids shelter between the bud-scales for hibernation and puncture the rudimentary leaves where the eggs are later deposited. Infested leaves should be collected and burned. As soon as signs of infestation appear, repeated sulphur treatments are necessary. On apple trees, *Aphis pomi* (*mali*) and *Eriosoma lanigerum* were abundant. For dealing with the latter, the residue of acetylene gas or calcium carbide sludge is used. At the beginning of winter a hole—with a radius of about 3 ft.—should be dug to expose the roots, and a milk made of this substance poured in, 4½ to 6 pints being sufficient for a good-sized tree. This should kill both insects and eggs on the roots. The branches and trunks should be whitewashed with the same solution, care being taken to penetrate all crevices. As soon as the solution is absorbed, the hole should be filled in again.

DE VILMORIN (P. L.). **Note sur les Dégats causés par la Tordeuse des Bourgeons du Pin (*Evetria buoliana*, Schiff.) dans les Collections de Verrières.** [Note on the Damage caused by the Pine-shoot Moth in the Plantations at Verrières.]—*Bull. Soc. Path. Vég. France*, [*sine loco*], iv, no. 2, 1917, p. 83. (Extract in *Jl. Soc. Nat. Hortic. France, Paris*, xix, June 1918, pp. 90–91). [Received 13th August 1918.]

Pine plantations at Verrières, and particularly the younger trees, have during recent years suffered considerably from the attacks of *Rhyacionia* (*Evetria*) *buoliana*, Schiff. (pine-shoot moth), which destroys the shoots and greatly deforms the trees. *Pinus ponderosa*, *P. sabiniana*, *P. taeda*, *P. contorta* and *P. muricata* are the chief species attacked. The larvae construct a gallery within the shoot, where pupation occurs in the first half of June, the moths appearing in the latter half of June and early July. The only successful control measure seems to be the collection and destruction of infested shoots containing larvae or pupae. Several species of Ichneumonids are parasitic upon *R. buoliana*, and it is suggested that infested shoots should be placed in vessels that would prevent the escape of the moths while releasing the parasites.

FRON (M. G.). **Note sur le Tigre du Rhododendron.** [Note on *Stephanitis rhododendri*.]—*Jl. Soc. Nat. Hortic. France, Paris*, xix, no. 4, June 1918, pp. 91–93, 1 fig. [Received 13th August 1918.]

A pest new to France has recently occurred on rhododendrons in the neighbourhood of Paris. This is the Tingid, *Stephanitis rhododendri*, Horv., which first appears in early spring and is found abundantly on the lower surfaces of the leaves in June. Eggs are deposited towards the end of July and August in the leaves and these hibernate until the following spring. Remedial measures include nicotine sprays, or soap and pyrethrum, which must be applied to the lower surface of the leaves. Tobacco fumigation under a tent is also recommended: hydrocyanic acid gas fumigation would doubtless also be successful if carried out by experienced persons.

TEODORO (G.). **Alcune Osservazioni sui Saccaromiceti del *Lecanium persicae*, Fab.** [Some Observations on the Saccharomycetes of *Lecanium persicae*.]—*Redia, Florence*, xiii, no. 1–2, 23rd July 1918, pp. 1–5.

Like other Coccids and many other insects also, *Eulecanium* (*Lecanium*) *persicae* harbours a species of saccharomycete that can be hereditarily transmitted and that lives free in its host in the form of saccharomycetiform cells.

MALENOTTI (E.). **Nuovi Calciditi.** [New Chalcidids.]—*Redia, Florence*, xiii, no. 1–2, 23rd July 1918, pp. 77–92, 17 figs.

The number of Chalcidids known to parasitise *Chrysomphalus dictyospermi* are increased to eight by the addition of *Aphelinus bovelli*, which is described from specimens from Barbados. A full description is given of the Mymarid, *Metalaptus torquatus*, on which a preliminary note has been published [see this *Review*, Ser. A, v, p. 337]. Though taken from orange leaves attacked by *C. dictyospermi*, it is not believed to parasitise this scale, since a careful examination of the infested material revealed the presence of some Psocids and Microlepidopterous larvae, of which it may be a parasite, as is the case with other Mymarids.

BERLESE (A.). **Su una nuova Specie di Trombidide, appartenente ad un nuovo Genere, supposta Parassita, allo Stato di Larva, delle Cavalette, in Puglia.** [A new Species of Trombidiid, belonging to a new Genus and believed to be parasitic on Locusts Nymphs in Apulia.]—*Redia, Florence*, xiii, no. 1–2, 23rd July1918, pp. 93–97, 1 plate. Also Emendation after p. 198.

The Trombidiid mite described in this paper is *Calothrombium paolii*, gen. et sp. n. The conditions under which it was found in Apulia seem to indicate that it is a parasite of *Dociostaurus maroccanus*.

BERLESE (A.). **Centuria quarta di Acari nuovi.** [Fourth List of One Hundred new Acari.]—*Redia, Florence*, xiii, no. 1–2, 23rd July 1918, pp. 115–192.

This paper describes one hundred new Acarids from various parts of the world.

Reports on the State of the Crops in each Province of Spain.—*Bol. Agric. Técnica y Económica, Madrid,* x, no. 114, Juue 1918, pp. 510–532. [Received 16th August 1918.]

In the province of Gerona arsenical sprays have been used against *Colaspidema atrum* infesting lucerne. In Guadalajara the Chrysomelid, *Haltica ampelophaga*, has injured vines, and apples have been damaged by *Hyponomeuta malinellus*. In Huelva in the holm-oak forests an area of about 24,000 acres has been infested by *Tortrix viridana*. *Aelia rostrata* is present on wheat, though the damage is not expected to be serious. This pest is also reported from Huesca. In Saragossa early-sown fields have suffered from the attack of *Haltica*.

Lobo (B.). **A Lagarta rosea da** *Gelechia gossypiella*. [The Pink Bollworm, *Pectinophora gossypiella*.]—*Rio de Janeiro*, 1918, 192 pp., 7 figs., 3 maps. [Received 15th August 1918.]

This is a report of a journey to Egypt undertaken in 1917 by direction of the Brazilian Ministry of Agriculture in order to study *Pectinophora gossypiella* and the measures adopted against it, with a view to combating it in Brazil, where it has appeared in recent years. Supplements to this report include the Egyptian regulations and a plan of work to be adopted in Brazil. This plan was drawn up by a commission, including the author, on the latter's return from Egypt and is to a great extent based on the measures practised there. The need for developing railway and road communication in the cotton-growing regions is urged, as ready access to all parts is a preliminary condition if combative measures are to be carried out.

Zimmermann (H.). **Lebensweise und Bekämpfung der Erdraupe** (*Agrotis segetum*, **Schiff.**). [The Life-History of *Euxoa segetum* and Methods for combating this Pest.]—*Fühling's Landwirtschftl. Zeitung, Stuttgart,* lxvii, no. 7–8, 1st—15th April 1918, pp. 130–148.

This is a record of observations made during many years on *Euxoa segetum* in Mecklenburg, where the outbreak of this moth in 1917 was exceedingly severe. The various stages of the cutworm are briefly described. Usually the larvae in late autumn go deeper underground and overwinter there, but cases of pupation occasionally occur in the same year and these pupae overwinter below ground. The overwintered larvae appear in the following spring and feed before pupating, but the damage they do at this time is negligible. The feeding-period and plants attacked vary in different years. The larvae can resist low temperatures, and one individual was seen crawling over snow. Up to the present distinct generations have not been noticed in Mecklenburg in the same year, but larvae in varying stages of development occur contemporaneously. In 1917 for instance, larvae ranging from 2 to 30 mm. in size were seen during the chief feeding-period, beginning about 20th July and ending early in August. This variation may be due to unequal hatching and growth. In some cases premature mortality was caused in August by a bacterial disease similar to the flacherie of the silkworm, but experiments with infected silkworms negatived the hope of utilising this germ as a check, as the disease among the cutworms ceased with the advent of cooler weather.

In 1917 there was a remarkable increase of *E. segetum* in Mecklenburg, many districts being infested for the first time, and considerable

damage was done. Besides cultivated plants many weeds were destroyed. Continued warm and dry weather in spring and early summer (as in May-June 1917) undoubtedly favours the development of *E. segetum*, and the danger of injury on a large scale is increased by prolonged dry weather in July and August. The dry weather also retards the growth of the plants and reduces their powers of resistance. The unusual severity of the damage was due to the young stages of both larvae and their food-plants occurring at the same time. For instance, white-fleshed swede turnips could not be planted before July because of the drought, so that the young plants and the first developmental stage of the cutworms were contemporaneous. Tables are given showing the relation between weather and cutworm injury from 1913 to 1917. Showers and even heavy rain do not seem to check the insects in the warm seasons, but the injury decreases after prolonged rainfall in cool weather in autumn. Heavy clay soils favour *E. segetum*, though there are some records of injury to sugar-beet in light and medium soils. Loose soil is favourable to infestation, but damp and shady places are avoided by the cutworms.

Preventive and remedial measures are dealt with at length. The chief outbreak (middle and end of July) must be avoided by early sowing, and rapid growth in such crops as sugar-beet, fodder-beet, carrots and swedes must be encouraged, and potatoes must be isolated from infested fields by trenches. Under similar circumstances winter grain must be sown as late as possible. The preceding year's crop does not *per se* influence attack, but when sowing oil-producing plants and winter grain it is very necessary to ascertain if they are being sown in ground previously infested. Fallow ground, especially when manured, requires very careful scrutiny. As a general rule both labour and money will be wasted if such ground is re-sown too early. Heavy losses were incurred in Mecklenburg in 1917 from this cause. Wheat sown at a late date—not before 15th September—is the best crop for sowing on land where cruciferous plants have been destroyed by cutworms. Winter rye, sown after 15th September, is also a good crop for infested fields. Early and semi-early potatoes are particularly attacked, while late varieties suffer little or not at all. Besides making trenches in order to protect uninfested land, they may also be dug to isolate foci of infestation in given fields. The cutworms trapped in the trenches may be fed to poultry. Manuring infested ground with kainit, potash, ammoninm superphosphate, potassium chloride, etc., proved useless. Hand-collection is not recommended, but may be resorted to, when potatoes are being dug. Poultry will prevent much damage on infested ground and such birds as rooks, pheasants, gulls, storks, etc., should be encouraged. Bait-traps prepared with molasses are useful during the flight-period of the moths, and spraying the foliage with Paris green may be resorted to against the larvae. It is a difficult matter to check this moth on account of its habits, and further work on the subject is necessary.

Ultée (A. J.). **Verslag over het Jaar 1915.** [Report of the Besoeki Experiment Station for 1915.]—*Meded. Besoekisch Proefstation, Djember*, no. 22, 1916, 20 pp.

A borer attacking *Hevea* in the Djember district, Java, appears to be the Longicorn, *Dihammus fistulator*, not previously recorded as a pest of this variety of rubber.

The following preliminary notes are given regarding the locust *Cyrtacanthacris nigricornis*: The egg-stage lasts about 3–4 months. The larvae moult six times and reach maturity after 2–2½ months. Mating takes place one month after the last moult. Eggs are deposited from 3 to 7 times at average intervals of 12 days. The adult locust lives for 4 months.

KEUCHENIUS (P. E.). **Phytopathologische Aanteekeningen over** *Hevea*. [Phytopathological Notes regarding *Hevea*.]—*Meded. Besoekisch Proefstation, Djember*, no. 24, 1917, pp. 49–54.

A nocturnal borer of *Hevea*, which confines its attack to the smooth-scraped tapping surfaces, was reported from the Banjoewang district; it is probably a Scolytid beetle. *Dihammus fistulator*, Germ., was bred from larvae boring into *Hevea*. Borer infestation of *Hevea* is speedily followed by the cessation of the flow of latex. The larvae must either be picked out or killed *in situ* by means of benzine. *Xylotrupes gideon*, L., known as a pest of sugar-cane and coconut, was noticed feeding on the latex, but this curious habit cannot be classed as injurious. In 1916 about 346 acres of *Hevea* were defoliated by *Cyrtacanthacris nigricornis*. Laboratory specimens of this locust (bred from the same egg-mass) mated and oviposited in February and March. The resultant eggs required from 5 to 9 months to incubate, a variation which accounts for the infestation lasting for half a year and for the simultaneous presence of adults and larvae, both of which thus belong to the same generation. Some eggs belonging to the batch mentioned above had not hatched out after 9 months and were accidentally destroyed before they did so. The newly hatched larva is 7 mm. long; it immediately begins feeding and grows rapidly. The first moult occurs after 7–8 days and the second after an average interval of 12 days.

RUTGERS (A. A. L.). **Infektieproeven met een Schimmel, die pathogeen is voor Insekten (*Metarrhizium anisopliae* (Metschn.) Sorokin).** [Infection Experiments with *Metarrhizium anisopliae*, a Fungus pathogenic to Insects.]—*Meded. Laboratorium voor Plantenziekten, Buitenzorg*, no. 25, 1916, 9 pp.

The experiments described in this paper were undertaken in order to ascertain the value in Java of the fungus, *Metarrhizium anisopliae*, and could not be completed, as the author was transferred to another appointment. The results obtained with regard to *Leucopholis rorida* and *Cyrtacanthacris nigricornis* are tabulated. Experiments were also conducted with *Oryctes rhinoceros*. None of the results justify much hope of this fungus being economically valuable against these insects.

RUTGERS (A. A. L.). **Onderzoekingen over het ontijdig Afsterven van Peperranken in Nederlandsch-Indië. III. De Pepercultuur in de Lampongsche Districten.** [Investigations on the premature dying-out of Pepper Vines in the Dutch East Indies. III. Pepper Cultivation in the Lampong Districts.]—*Meded. Laboratorium voor Plantenziekten, Buitenzorg*, no. 27, 1916, 65 pp., 14 plates.

This third and last contribution on pepper and its diseases [see this *Review*, Ser. A, v, p. 442] has had to be published while the

investigations were incomplete. Pepper has been the chief crop in the Lampong districts (Sumatra) for about 200 years and the [annual] amount reaches about 26,000,000 lb., or half the pepper production of the Dutch East Indies.

The Nematode, *Heterodera radicicola*, Greef, occurs everywhere, but does no injury. Both stem-borers and fruit-eating weevils are of minor importance.

Dadap (*Erythrina*), which is used for shading and supporting the pepper-vines, is attacked by a Longicorn, *Batocera*, and a Pyralid moth, *Terastia*. The former may be collected or their larvae cut out, while the latter may be checked by severe pruning and burning the cuttings. The dadap leaf-hopper, *Typhlocyba erythrinae*, Kon., appears to be less injurious than is the case in Java.

van Hall (C. J. J.). **Ziekten en Plagen der Cultuurgewassen in Nederlandsch-Indië in 1916.** [Diseases and Pests of cultivated Plants in the Dutch East Indies in 1916.]—*Meded. Laboratorium voor Plantenziekten, Buitenzorg*, no. 29, 1917, 37 pp. [Received 10th July 1918.]

The majority of the insect pests dealt with in this report have already been recorded in earlier and subsequent ones [see this *Review*, Ser. A, v, p. 442 and vi, p. 349]. In general but little insect injury was recorded in 1916 owing to the unusually wet dry season of 1915.

Arachis [*hypogaea*] was attacked by a species of *Anomala*, believed to be *A. atrovirens*.

In the Malang district little damage was done by locusts owing to the presence of a parasitic beetle, *Epicauta ruficeps*, which was abundant on the estates that had suffered most in 1915. Cinchona was infested with *Nygmia* (*Euproctis*) *flexuosa* and the young plants were attacked by *Helopeltis antonii*. Other pests of this crop included the caterpillars of *Cricula trifenestrata*, *Odonestis plagifera*, *Metanastria hyrtaca* and *Hyposidra* sp. The mahogany plantations of the Forestry Department were severely attacked by Pyralid caterpillars, probably *Hypsipila* sp. Rice was injured by *Cirphis unipuncta*, *Cnaphalocrocis jolinalis* [? (*iolealis*, Wlk. =) *medinalis*, Gn.], *Schoenobius bipunctifer*, *Scirpophaga* sp., a gall-midge (*Cecidomyia* sp.), *Prodenia litura*, *Nymphula*, *Podops* and *Anomala*. Galls, formed by a Psyllid, were found on the leaves of *Eugenia polyantha*. The tea-seed fly, *Adrama* [*determinata*], was observed on many estates and planters were urged to take energetic action against it. A Scolytid borer infesting tea was believed by the planters to be *Xyleborus coffeae*, but this is doubtful.

Becker (G. G.). **The Round-Headed Apple-Tree Borer,** *Saperda candida*, **F.**—*Univ. Arkansas Agric. Expt. Sta., Fayetteville*, Bull. no. 146, July 1918, 92 pp., 17 plates.

Saperda candida, F., which has a wide distribution in North America, is considered the most destructive orchard pest in the Ozarks. The food-plants include quince, apple and pear, and wild hosts such as *Amelanchier canadensis*, wild crab, mountain ash, thorns (*Crataegus* spp.) and chokeberry (*Pyrus arbutifolia*). The life-cycle in the Ozarks

occupies two years. Eggs are deposited in cuts made in the trunks of trees, usually within half an inch of the ground. After an incubation period of two weeks the larvae begin feeding in the inner bark. During the second year the hardwood is penetrated; by the end of the second season the larvae attain their full growth and pupate in the hardwood. The number of instars in the larval period varies, but there are usually at least six. It is believed that the larvae may be reared to maturity in apples. Pupation usually takes place in April, the pupal stage lasting about three weeks. Adults frequently remain in the trees for some days after transformation, oviposition occurring some 10 days after emergence. The beetles feed extensively on the bark of twigs, on the ribs of leaves and even on the fruit during the time they are visible in the orchard. Trees between 3 and 10 years old are preferred for attack. The chief recommendation for the control of this insect is the cutting out of individual larvae from their burrows in early August (for the Ozarks) and in April. Adults can be controlled on young trees by spraying them with 1 lb. arsenate of lead to 50 U.S. gals. water. Trees that are planted in the vicinity of infested orchards may be protected with an asphaltum-linseed oil compound which should be applied at a temperature of not over 239° F. Trees under 4 years of age cannot be treated with this substance without injury.

BECKER (G. G.). **The Peach-tree Borer,** ***Sanninoidea exitiosa*****, Say.**—*Univ. Arkansas Agric. Expt. Sta., Fayetteville,* Bull. no. 150, June 1918, 32 pp., 2 plates.

Most of the biological data concerning *Aegeria* (*Sanninoidea*) *exitiosa* that are included in this bulletin have previously appeared [see this *Review*, Ser. A, v, p. 207]. Natural enemies include many predaceous insects that attack the young larvae. Some hundreds of eggs of *A. exitiosa* were reared for parasites, but none were obtained. In experimental work with pupae, two Hymenopterous parasites were reared, namely, *Elachistus sanninoideae*, Gir., and *Microbracon sanninoideae*, Gahan. The Dipteron, *Sarcophaga helicis*, Towns., was also reared from a pupa, but it is not certain whether this fly is a true parasite. Many pupae are apparently killed by ants.

Various remedies that were tried and proved ineffective or impracticable in controlling this borer include wrapping papers, tree veneers, white lead paint, asphaltum on the trunk, lime-sulphur, tanglefoot, tree protectors, tree collars, asphaltum compounds used to seal the crack between the trunk of the tree and the soil, nicotine preparations at different dilutions, carbolineum, carbon bisulphide and heat. The only efficacious method seems to be that of worming or cutting out the larvae from the burrows [see this *Review*, Ser. A, v, p. 368].

MCCRAY (A. H.). **The Diagnosis of Bee Diseases by Laboratory Methods.**—*U.S. Dept. Agric., Washington, D.C.,* Bull. no. 671, 21st June 1918, 15 pp., 2 plates.

This paper discusses bee diseases, including European foulbrood, American foulbrood, sacbrood, *Nosema* disease, and various non-infectious diseases, and gives the laboratory methods of diagnosis for the benefit of those who may be engaged in similar work.

JONES (P. R.). **Machine Gun Work with a new Formula on Red Spiders in Tulare County.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, vii, no. 7, July 1918, pp. 455–457.

Measures against *Tetranychus telarius* (red spider) are usually carried out by means of sulphur fumes from dry applications, or by contact action from petroleum solutions, soap decoctions, or wet sulphur sprays of either lime-sulphur, atomic sulphur, sodium sulphide or potassium sulphide combinations. Under favourable conditions each of these methods may be efficacious, but in order to obviate the disadvantages arising from their use in any but the most favourable circumstances, the author has been experimenting with the object of obtaining a spray that would combine the advantages of each method without its disadvantages.

A high pressure of 250 to 275 lb. is necessary for this spray, which should be sufficiently coarse to give it driving power to penetrate the webs of the red spider. The formula that proved most successful was 6 U.S. gals. Orchard brand lime-sulphur solution, 2 U.S. gals. Triumph miscible oil, and 1 lb. ground glue, for a 200 U.S. gal. spray tank. In preparing the spray, 5 lb. of ground glue was thoroughly dissolved in 5 U.S. gals. water. Two U.S. gals. Triumph oil were put in another receptacle and 1 U.S. gal. of the glue solution stirred into the oil. Water was then added and the mixture stirred until 5 U.S. gals. of a thin creamy emulsion were obtained. The spray tank was filled with water to which the 6 U.S. gals. lime-sulphur were added. The oil and glue mixture was added just before the spray was used. The results of this spraying were excellent; from 5 to 10 minutes after the spray had dried, thousands of dead mites were found on both surfaces of the leaves, and no living individuals were seen. The free sulphur continued to act for a long period on the young hatched from the eggs.

For general work throughout the State it is probable that 4 U.S. gals. lime sulphur, 1 U.S. gal. oil and 1 lb. glue would be sufficient for a 200-gal. spray tank. It is hoped to carry out further experiments with this formula on trees in fruit.

TANAKA (Dr. T.). **A New Codling Moth attacking the Persimmon in Japan.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, vii, no. 7, July 1918, pp. 462–463.

The larva of the Momphid, *Kakivoria flavofasciata*, Nagano, causes serious damage to persimmon fruit in Japan. There are two generations of the moth in a season and each larva usually attacks from 4 to 6 fruits; in many cases the crop is ruined by these insects and trees are left without a single fruit. The sweet fruits are particularly liable to attack and should be encased in bags as a protection.

SEVERIN (H. H. P.). **Fruit Flies of Economic Importance in California.** *Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, vii, no. 7, July 1918, p. 464.

Straussia longipennis, Wied. (sunflower fly) has been several times collected in California. In New York it has been observed ovipositing

in the stalk of the sunflower; in Maine, the stalk of the Jerusalem artichoke (*Helianthus tuberosus*) was selected for oviposition, larvae being found in long tunnels that they had made in the stalk. At Orono, adults were found mating in the field in June and early July.

JONES (P. R.). **Thrips Damage in Tulare County Citrus Groves.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento,* vii, no. 7, July 1918, p. 465.

Scirtothrips citri, Moul. (citrus thrips) has been unusually abundant in Tulare County orange groves. Orchards that were sprayed with a high dosage of lime-sulphur and Triumph miscible oil showed a marked freedom from this pest in comparison with fumigated or untreated orchards, owing to the heavy coating of lime-sulphur keeping some of the eggs from hatching, or preventing the thrips from attacking the first spring growth. This spray, if applied just after the blossoms had fallen, would have prevented all damage by the pest.

Pest Control for July.—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento,* vii, no. 7, July 1918, pp. 473–476.

This paper deals with the commoner pests of stone fruits, including peach, apricot, prune, plum, cherry and almond, with suggestions for their control. Few scientific names are given, but special attention is drawn to the beetle, *Serica alternata*, and to the moths, *Schizura concinna*, *Pseudohazis eglanterina* and *Malacosoma* spp., attacking the foliage of stone fruits.

MASKEW (F.). **Quarantine Division. Report for the Month of May 1918.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento,* vii, no. 7, July 1918, pp. 479–480.

The following pests were intercepted during the month of May:—From Central America: *Aspidiotus cyanophylli* and *Pseudococcus* sp. on bananas; larvae of an unidentified weevil in tree seeds. From Hawaii: *Pseudococcus bromeliae* and *Diaspis bromeliae* on pineapples; *Coccus longulus* on betel leaves. From Holland: *Lepidosaphes ulmi* on boxwood; *Aphis* sp. on juniper. From Japan: *Pseudococcus* sp. on umbrella pine; weevil larvae in chestnuts; *Pseudaonidia duplex* and a Psyllid on azaleas; Cerambycid larvae in crowns and roots of flowering cherry. From Mexico: *Heliothis* (*Chloridea*) *obsoleta* in tomatoes. From Nevada and Oregon: *Heterodera radicicola* in potatoes. From Arizona: *Pseudococcus* sp. on egg-plant. From Massachusetts: *Pulvinaria* sp. on *Dipladenia*. From New Jersey: *Cerataphis lataniae*, *Pulvinaria* sp. and *Eucalymnatus tessellatus* on orchids. From Texas: *Chrysomphalus aonidum*, *Lepidosaphes beckii* and *Phomopsis citri* on grape-fruit. From Washington: *Rhizoctonia* on potatoes. From Ohio: *Aleurodes* sp. on citrus stock. From Louisiana: *Aspidiotus cyanophylli* on bananas. From Tasmania: Larvae of *Cydia pomonella* in apples. From Cuba: *Pseudococcus* sp. on pineapples.

FELT (E. P.). **Thirty-second Report of the State Entomologist on Injurious and other Insects of the State of New York, 1916.**—*New York State Mus. Bull., Albany, N.Y.*, no. 198, 1st June 1917, 276 pp., 8 plates, 54 figs. [Received 16th August 1918.]

This valuable report deals comprehensively with the more important insect pests of 1916, including such fruit tree pests as *Cydia pomonella*, L., *Rhagoletis pomonella*, Walsh, *Taeniothrips inconsequens*, Uzel (*pyri*, Dan.), *Malacosoma americana*, F., *Psylla pyricola*, Forst., *Aspidiotus perniciosus*, Comst., and others.

Shade-tree insects include the sawfly, *Caulacampus acericaulis*, MacG. (maple leaf-stem borer), *Mycetobia divergens*, Wlk. (bleeding tree maggot), *Chaitophorus lyropicta*, Kessler (Norway maple Aphid), recorded in former reports as *C. aceris*, and *Eulecanium magnoliarum*, Ckll. (magnolia scale). Forest pests include *Scolytus* (*Eccoptogaster*) *quadrispinosus* (hickory bark-beetle), *Sinoxylon basilare*, Say (red-shouldered limb borer) and *Neoclytus erythrocephalus*, F.

Numerous garden pests are recorded, the lesser known species including *Papaipema purpurifascia*, G. & R. (columbine borer), *Epargyreus tityrus*, F. (silver-spotted skipper) attacking locust trees and wistaria, *Achatodes zeae*, Harr. (spindle worm), attacking elder and also reported from maize, and *Zophodia grossulariae*, Pack. (gooseberry fruit worm).

Greenhouse pests include *Callopistria floridensis*, Gn. (Florida fern caterpillar), which ruined over 3,000 ferns belonging to one grower, Boston and maiden-hair fern being the species preferred. This moth breeds practically throughout the year. The use of poisons being apt to injure the plants, hand-picking is the measure recommended, but above all, every precaution against the introduction of the moth should be taken. *Neocerata* (*Dasyneura*) *rhodophaga*, Coq. (rose gall midge) is frequently the cause of serious loss, attacking the young leaf or flower buds and causing malformations. Breeding is continuous from May to October, only two weeks being required to complete the life-cycle. Eggs are laid in the developing rose tips. As the repeated fumigations necessary to destroy the larvae are apt to endanger the plants, it is suggested that the greenhouse should be thoroughly cleared out during the winter when the insects are dormant in the soil, or thoroughly sprayed with a contact insecticide such as kerosene emulsion. *Diarthronomyia hypogaea*, Lw. (chrysanthemum gall midge) is a recently introduced pest that is rapidly becoming widely disseminated. It has been fully described in a previous report [see this *Review*, Ser. A, iv., p. 445].

Grass and clover insects include the white grubs, *Lachnosterna* (*Phyllophaga*) *fusca*, Frohl., which in some cases greatly injured potato crops. Planting of crops should be timed so that white grub injury will be at the minimum. The grubs have been largely held in check during 1917 by the Asilid, *Promachus fitchii*, O.S. *Hypera* (*Phytonomus*) *meles*, F., is a weevil found on red clover, in association with *Tychius picirostris*, F. Early cutting of clover for hay prevents serious injury by these insects.

Miscellaneous insects that have been troublesome include *Silvanus surinamensis*, L. (saw-toothed grain beetle), a common species in cereal preparations and found occasionally in large numbers in grain

bins. The remedy is to clean out granaries and grain bins every few months; thorough fumigation with carbon bisulphide or hydrocyanic acid gas should be given when necessary. *Barypeithes pellucidus*, Boh., is a recently introduced weevil, found feeding upon dead leaves in an apple orchard. It is said to attack strawberry plants in Europe. *Diestrammena marmorata*, Haan (Japanese spotted camel cricket) is nocturnal in habit, living under logs and stones and in moist woodlands. These insects are said to be almost omnivorous, readily eating meat, fruit and vegetables. If injury from them should become serious, Kansas bait should be used to destroy them.

Carbon tetrachloride was tested as a museum fumigant with very satisfactory results. It was used at the rate of approximately one-eighth pint to 2½ cub. ft. of space. The insecticide was placed in a series of several watch-glasses so as to secure a maximum evaporating surface, and the case was tightly closed for 2 or more days. This fumigation killed beetles and larvae, but was apparently ineffective against the eggs of *Attagenus piceus*, Oliv. (black carpet beetle). It is a much safer fumigant than carbon bisulphide.

This bulletin also contains a lengthy appendix which constitutes Part V of the author's valuable monograph on gall midges.

WORSHAM (E. L.). **Twentieth Annual Report of the State Entomologist for 1917.**—*Georgia State Bd. Entom., Atlanta*, Bull. no. 51, January 1918, 44 pp., 3 figs. [Received 19th August 1918.]

Damage to cotton by *Anthonomus grandis*, Boh. (Mexican cotton boll weevil) has on the whole been considerably less than in 1916. Research work on this pest includes studies in hibernation, longevity, food-plants, general biology and control. Dusting with arsenate of lead and sulphur was tried, but more extensive experiments are necessary before definite conclusions can be reached. The quarantine regulations against this weevil are stringent.

Dusting experiments against apple insects, which were compared with liquid spray treatments, indicated the superiority of the former method as regards codling moth (*Cydia pomonella*). Dusting also proved effective on peach trees for the control of peach curculio [*Conotrachelus nenuphar*]. The dilution of the active elements of the dust spray with a cheap filler would considerably reduce the expense of the mixture to the grower; further experiments to determine the extent of this dilution are desirable.

The work on pecan insects begun in 1916 has been continued [see this *Review*, Ser. A, v, p. 483]. *Acrobasis nebulella* (pecan-leaf case-bearer) continues to be the most serious pecan pest in the State, and has received considerable attention. Several new parasites have been reared, but are as yet unidentified. The greatest mortality seems to occur at the time of autumn migration, at emergence after hibernation, and at the earliest feeding of the larvae in the spring. The total annual mortality for the species is over 90 per cent. Spraying with arsenate of lead and lime, as previously recommended [*loc. cit.*], continues to be beneficial; in order to obtain the greatest advantage an angled disc-nozzle should be used on one line of hose and a Bordeaux nozzle on the other, one person dealing with the lower portion of the tree and another with the top. Indications point to the fact that

dusting, if properly done, should be almost, if not quite, as satisfactory as spraying. *Acrobasis hebescella* has been much less important than in 1916, owing to the large degree of parasitism and in part also to summer sprayings. *Hyphantria cunea* (fall web-worm), which caused severe damage in 1916, has been studied. There are evidently two complete generations and a partial third one annually, some of the second brood failing to emerge the first year and hibernating as pupae, as do all of the third brood. *Proteopteryx deludana* (bud worm) has been studied in the laboratory. There are several generations of this moth in a year; the first generation pupates under loose bark on the trunks of the trees, while later generations use folded leaves in which to pupate. It seems probable that the first brood might easily be trapped under bands placed round the trunks.

Nezara viridula (green soldier bug), which was a serious pest in 1916, has been reduced almost to a minimum, probably owing to natural parasites. It seems evident that the disease known as kernel spot is either caused directly by these bugs or carried by them [see this *Review*, Ser. A, vi, p. 433].

The sweet potato root weevil [*Cylas formicarius*] has recently been found in one locality in Georgia. Instructions for control were at once sent to the infested districts and it is hoped that it may be exterminated before the infestation has spread.

BEAL (F. E. L.). **Food Habits of the Swallows: A Family of Valuable Native Birds.**—*U.S. Dept. Agric., Washington, D.C.*, Bull. no. 619, 8th March 1918, 28 pp., 2 plates. [Received 20th August 1918.]

This bulletin records the usefulness of various species of swallows in insect control, and gives lists of the insects preyed upon by each species.

McCLINTOCK (J. A.). **True Nature of Spinach-Blight and Relation of Insects to its Transmission.**—*Jl. Agric. Research, Washington, D.C.*, xiv, no. 1, 1st July 1918, pp. 1–59, 12 plates.

It has been observed for some years past that spinach-blight, which is the cause of the greatest annual loss to growers in eastern Virginia, became most serious within a short time after Aphids were observed to be abundant on the plants. Spinach is grown in autumn, winter and early spring, during which period *Macrosiphum solanifolii*, Ashm. (potato aphis) and *Myzus* (*Rhopalosiphum*) *persicae*, Sulzer (spinach aphis) are the most abundant insects on the plants.

M. solanifolii, owing to its habits, has proved to be the more important agent in the dissemination of the disease. Experiments showed that direct transfers of virus-bearing Aphids to healthy plants produced infections of spinach-blight; inoculation with the juice of crushed infected Aphids also produced infection. Transfers of Aphids that had not previously fed on diseased material produced blight infection in a few cases. Virus-bearing Aphids produced infections in healthy plants when allowed to feed on them for two minutes. The infectivity is proved to be greater with adult Aphids than with those that are immature, and the incubation period of the disease produced by the adults is materially less than when the disease is produced by immature forms. Aphids are capable of

carrying infection to several healthy plants after leaving a diseased host. Supposedly non-virus-bearing Aphids were found to cause blight infection when transferred to healthy spinach. Aphids imported from several other States, or the juice crushed from such Aphids, did not cause infections of the disease unless they had previously fed on diseased spinach. Uninfected Aphids must remain on diseased plants for from 5 minutes to 14 hours to become carriers of infection. Infected individuals do not lose their ability to transmit the causal entity of spinach-blight during moulting. Infections were obtained with the offspring of virus-bearing Aphids that had not previously fed and the infectious entity of spinach-blight was found to be transmitted by adult Aphids to their offspring. It was also found that when Aphids were reared on lettuce for four consecutive generations, a few of the fourth generation were virus bearers and produced infections when they were transferred to healthy spinach. These results show similarity to certain animal diseases transmitted by insects or ticks. Since the causal factor of the disease may be hereditary with the Aphids, the possibility of its lasting through the summer by this method was indicated. Aphids collected on spinach plants left after the crop had been harvested were found to be possible virus bearers, as also are Aphids collected from weeds growing later in the season in the same fields. Experiments with Aphids from plants other than spinach during the autumn produced spinach-blight in a limited number of cases. The direct offspring of a known virus-bearing Aphid reared during the summer in a field cage on pepper and potato plants produced blight when they were transferred to spinach seedlings in August, or about the time early spinach is appearing. Infections were obtained in a few cases with several other species of Rhynchota, but these are probably unimportant as blight transmitters, as they do not occur abundantly at the time blight is prevalent. The control of the Aphids infesting spinach therefore offers the most immediate possibilities for the control of spinach-blight.

RITCHIE (A. H.). **Cucumber and Pumpkin Worms.**—*Jl. Jamaica Agric. Soc., Kingston*, xxii, no. 6, June 1918, pp. 240-241.

The caterpillars of *Diaphania hyalinata* periodically attack the foliage of cucumbers and related plants. White lime dusted over the the plants acts as a repellent, but if the plants become infested a poison spray must be resorted to. Lead arsenate in the proportion $2\frac{1}{2}$ lb. to 40 gals. water is recommended; this should be coated over the under-side of the leaves as soon as the caterpillars make their appearance.

NOWELL (W.). **Internal Disease of Cotton Bolls in the West Indies. II.** —*West Indian Bull., Barbados*, xvii, no. 1, 1918, pp. 1-26.

This paper records the continuation of studies on the internal boll disease of cotton and its connection with plant bugs [see this *Review*, Ser. A, v, p. 580 & vi, p. 251]. The success of the control measures against *Dysdercus* spp. (cotton stainers) in St. Vincent in 1917 was found to have reduced the prevalence of the disease to negligible proportions over large areas. *Nezara viridula* (green bug) and *Edessa*

meditabunda (pea chink) have both caused severe damage to cotton in some localities. It was found that the injury inflicted by these bugs, and in particular by *N. viridula*, prevents development of the lint and causes the shedding or drying up of young bolls. Direct injury to the bolls generally results in complete loss. Experiments showed that the punctures of *N. viridula* readily cause infection with the fungi of internal boll disease, but only when the bugs are transferred from infected plants. No infection was produced even in the latter case by *E. meditabunda*.

HUTSON (J. C.). **Notes on Certain Plant Bugs connected with Cotton in St. Vincent.**—*West Indian Bull., Barbados*, xvii, no. 1, 1918, pp. 27–39.

The information contained in this paper is based upon observations on plant bugs in St. Vincent which have previously been recorded [see this *Review*, Ser. A, vi, p. 249].

SANDS (W. N.). **Some Effects of Cotton Stainer Control in St. Vincent.** —*West Indian Bull., Barbados*, xvii, no. 1, 1918, pp. 40–46.

The benefits that have resulted from the measures adopted against *Dysdercus delauneyi*, Leth. (cotton stainer) in 1916–1917 [see this *Review*, Ser. A, v, p. 567, 581] are recorded. It is estimated that as a result of these measures cotton growers in St. Vincent benefited to the extent of several thousand pounds sterling. The latest Ordinances regarding the control of cotton stainer define the close season for cotton and render remedial measures compulsory on all infested estates.

SANDS (W. N.). **Notes on Trapping the Cotton Stainer in St. Vincent.** —*West Indian Bull., Barbados*, xvii, no. 1, 1918, pp. 47–49.

Details are given in this paper of the carrying out of remedial measures for *Dysdercus delauneyi* advocated in a previous paper [see this *Review*, Ser. A, v, p. 581].

HOUSER (J. S.), GUYTON (T. L.) & LOWRY (P. R.). **The Pink and Green Aphid of Potato.**—*Ohio Agric. Expt. Sta., Wooster*, Bull. no. 317, November 1917, 88 pp., 21 figs. [Received 30th August 1918.]

This bulletin describes a heavy infestation of *Macrosiphum solanifolii*, Ashm. (pink and green aphis of potato) that occurred in Ohio in 1917. While the plants most heavily infested were the potato (*Solanum tuberosum*, L.), tomato (*Lycopersicum esculentum*, Mill.), egg-plant (*Solanum melongena*, L.), pepper (*Capsicum annuum*, L.) and sunflower (*Helianthus annuus*, L.), many other plants, of which a list is given, were commonly though less seriously attacked. The nature and extent of the injury is discussed, both as regards potatoes and tomatoes.

Internal parasites of *M. solanifolii*, which constitute the greatest single factor operating in reducing the pest, include the Hymenoptera, *Aphidius polygonaphis*, Fitch, *Pachyneuron aphidivorum*, Ashm., and two species of the genus *Lygocerus*, the first-named being the most abundant. The Coccinellids predaceous on this Aphid are:—

Hippodamia convergens, *H. glacialis*, *H. parenthesis*, *H. tredecimpunctata*, *Adalia bipunctata*, *Coccinella novemnotata*, *C. sanguinea* and *Megilla maculata*. The Syrphids, *Syrphus americanus*, *Sphaerophoria cylindrica* and *Allograpta obliqua*, are also frequently found feeding upon the Aphids, but are themselves highly parasitised. Insectivorous birds, including sparrows, quails and poultry, are of considerable assistance in reducing the numbers. Heavy rain is detrimental to the Aphids as it washes a number of them from the plants, retards migration, and promotes conditions favourable for the development of entomogenous fungi.

Many spraying experiments with various substances are described and the best machines for the purpose are illustrated. The most highly recommended spray consists of 1½ to 2 teaspoonfuls of nicotine sulphate to one U.S. gal. of water, with sufficient soap to form suds. Two applications are usually necessary and should be given at not more than 3 days' interval. The necessity of thoroughly spraying the under-sides of the leaves is emphasised. Owing to the wide range of food-plants, clean cultivation is essential. It is considered that thorough spraying in the early stages of infestation will efficiently control *M. solanifolii.*

BRITTON (W. E.). **17th Report Connecticut State Entomologist for 1917.**—*Conn. Agric. Expt. Sta., New Haven*, Bull. no. 203, 1918, pp. 231–370, 32 plates.

This report, which embodies several papers on various pests that are dealt with in the succeeding abstracts, records several serious fruit pests during 1917, including *Cydia* (*Laspeyresia*) *molesta*, Busck, an account of which has been recently dealt with [see this *Review*, Ser. A, vi, pp. 369, 373]. The best methods of treatment have not yet been determined ; possibly dipping the trees in a miscible oil may prove effective. Clipping off the twigs in winter and lead arsenate spraying soon after the fruit sets will probably be of assistance.

Hyphantria cunea, Drury (fall web-worm) was exceptionally prevalent in 1917. Nearly all fruit, shade, ornamental and native woodland trees are attacked by this moth, which may cause complete defoliation. There is usually one annual generation in Connecticut, the larvae appearing in late autumn. Eggs are laid in a cluster under the leaves and hatch in about 10 days, the larvae forming a nest on the end of a branch. They are mature in about 6 weeks and pupate under rubbish or on fences or tree-trunks. Hibernation occurs in the pupal stage, adults appearing in July. Parasites include the Hymenoptera, *Apanteles hyphantriae*, Riley, *Meteorus hyphantriae*, Riley, and *Campoplex* (*Limneria*) *pallipes*, Prov. An egg-parasite, *Telenomus bifidus*, Riley, is also very effective. Less important parasites are *Campoplex fugitivus*, Say, *Apanteles lacteicolor*, Vier., *Pteromalus* (*Dibrachys*) *boucheanus*. Ratz., *Syntomosphyrum esurus*, Riley, and *Eremotylus glabratum*, Say. A Dipterous parasite, *Tachina* sp., is said to be very effective. Predaceous enemies include the bugs, *Euschistus servus*, Say, and *Podisus maculiventris*, Say, and the Mantid, *Stagmomantis carolina*, L., as well as *Prionidus cristatus*, L. (wheel bug) and the larva of the Carabid, *Plochionis timidus*, Hald. Control measures include clipping off and burning the nests or killing the

larvae in them by burning with a torch. Spraying with 3 lb. paste lead arsenate (or 1½ lb. powder) to 50 U.S. gals. water will prevent defoliation of the trees.

Halisidota caryae, Harris (hickory tussock moth) was more abundant than for many years, associated with *Hemerocampa leucostigma* (white-marked tussock moth) and *Halisidota tessellaris*, S. & A. *Halisidota maculata* occurs less frequently. These moths have a wide range of food-plants, including oak, elm, maple, walnut, hickory, willow, poplar, etc. Adults appear in June and July and eggs are deposited on the under-sides of the leaves, where the larvae feed. Spraying with 3 lb. paste lead arsenate to 50 U.S. gals. water is recommended as an efficient control.

Datana integerrima, G. & R. (walnut caterpillar) was numerous on black walnut, butternut and hickory, the larvae eating away the leaves during August and feeding in clusters near the ends of branches. Pupation takes place in the ground. There is only one brood in a year. The larvae are parasitised by *Meteorus communis*, Cress. The lead arsenate spray described above should be used. The conspicuous clusters of caterpillars can easily be removed. *Datana ministra*, Drury (yellow-necked caterpillar) is a closely allied species common on apple, especially on young trees. Injury and remedial measures are the same as for *D. integerrima*. *Schizura concinna*, S. & A. (red-humped caterpillar) is another species defoliating young apple trees. The caterpillars are parasitised by an Ichneumonid, *Campoplex* (*Ameloctonus*) *oedemisiae*, Ashm. Lead arsenate spray is recommended against it.

Insects injuring stored food-products in Connecticut include the grain beetles, *Tenebrio molitor*, L., *T. obscurus*, F., *Tenebrioides mauritanicus*, L., *Bruchus pisorum*, L., *B. obtectus*, Say, *B. quadrimaculatus*, F., *Sitodrepa panicea*, L., *Tribolium confusum*, Duv., *T. ferrugineum*, F., *Silvanus surinamensis*, L., *Calandra granaria*, L., and *C. oryzae*, L. Flour and meal moths include *Plodia interpunctella*, Hbn., *Ephestia kühniella*, Zell., and *Pyralis farinalis*, L. Grain moths include *Sitotroga cerealella*, Oliv., and *Tinea granella*, L. Insects occasionally attacking food are *Trogoderma tarsale*, Melsh., *Anthrenus verbasci*, L., *Attagenus piceus*, Oliv., *Dermestes lardarius*, L., *Necrobia rufipes*, F., *Tyroglyphus* spp., *Lasioderma serricorne*, F., *Piophila casei*, L., *Troctes divinatoria*, Müll., cockroaches and ants. A brief account is given of the most important of these pests. Most of them may be destroyed by raising the temperature to 120°–130° F. for 5 or 6 hours. Air-slaked lime applied to seeds when placed in storage will prevent most of the damage by pea and bean Bruchids [see this *Review*, Ser. A, v, p. 208]. Half a cupful of carbon bisulphide to a barrel of grain will destroy all insects. The liquid should be placed on the top of the container, which should then be tightly closed for 24 hours or more. Fumigation with hydrocyanic acid gas is described, but is not recommended for use by inexperienced persons.

Miscellaneous insects causing some trouble during the year included: A sawfly, *Janus abbreviatus*, Say, in twigs of Lombardy poplar; this species has not previously been reported from Connecticut. Another sawfly, *Itycorsia* sp., occurred on nursery plants of Austrian pine. A Longicorn, *Monochamus* (*Monohammus*) *titillator*, F., was found tunnelling in white pine. A leaf-roller, *Desmia funeralis*,

Hbn., was observed on Virginia creeper; a sawfly, *Diprion abietis*, Harr., on balsam fir; and twig-borers, *Oberea tripunctata*, Swed., on dogwood, and *O. tripunctata* var. *myops*, Hald., on azalea and *Oxydendrum*. *Agrilus sinuatus*, Oliv. (sinuate pear borer) was recorded for the first time from Connecticut; no remedy is known for this pest other than destroying infested trees. *Harrisina americana*, Harr., was found on Virginia creeper; the Psocid, *Pterodela pedicularis*, L., occurred in wheat middlings, heat being recommended for dealing with this pest; grubs of *Tyloderma foveolatum*, Say, tunnelling in stems of evening primrose; and larvae of *Chelymorpha argus*, Licht., on peas and wild morning glory.

The elm leaf beetle [*Galerucella luteola*] increased rapidly during the year and gave every indication of again appearing in devastating numbers. Residents in towns where the beetle has been numerous are asked to be on the watch and to spray the trees with lead arsenate as soon as the insects appear. One thorough application about 1st June will generally protect the foliage for the season. *Malacosoma neustria*, L., was intercepted from Holland in a shipment of *Malus* and other plants. *Malacosoma americana*, F., after a period of abundance lasting for two or three years has now practically disappeared from Connecticut. Larvae of *Marmara* (*Gracilaria*) *elotella*, Busck, the life-history of which has recently been studied [see this *Review*, Ser. A, vi, p. 21]. have been found mining in apple twigs, but apparently very little damage is done by them. *Olethreutes hemidesma*, Zell., was found on terminal shoots of *Spiraea*; if this moth should become very numerous a lead arsenate spray should be applied during July; clipping off and burning infested shoots is also advisable. *Pissodes approximatus*, Hopk., is an injurious weevil attacking red pine. Apparently only an occasional tree is attacked; the only measure that can be recommended is to destroy infested trees. *Contarinia tritici*, Kirby (wheat midge) has been found injuring rye, the larvae eating out the kernels in the hull. There is probably one brood in each year, though in certain seasons in some parts of the country there may be a partial second brood. Burning the stubble has been recommended as a remedial measure, followed by deep autumn ploughing and rotation of crops. Grasshoppers and crickets were unusually abundant during the season, and did considerable damage by eating the second crop of grass in many fields. The usual poisoned bran mash is recommended for their destruction.

BRITTON (W. E.) & DAVIS (I. W.). **Suppression Work against the Gipsy and Brown-tail Moths.**—*17th Rept. Connecticut State Entomologist for 1917, Conn. Agric. Expt. Sta., New Haven,* Bull. no. 203, 1918, pp. 246–258, 1 plate.

Measures against these two pests have been continued on the same lines as in preceding years [see this *Review*, Ser. A, v, p. 307]. The brown-tail moth [*Nygmia phaeorrhoea*] has not spread appreciably during the last two years; the clipping off and destroying of the winter nests has been continued, and very few webs have been observed. The gipsy moth [*Lymantria dispar*] has been numerous in the north-eastern counties. Every effort was made to visit all of the infested localities during the caterpillar season, and over 37,000 larvae were killed.

Scouting and creosoting egg-clusters, spraying badly-infested areas and banding have also been continued. Its enemies that have been introduced into Connecticut include the Carabid beetle, *Calosoma sycophanta*, L., the Tachinid, *Compsilura concinnata*, Meig., and the Hymenoptera, *Apanteles lacteicolor*, Vier., and *Anastatus bifasciatus*, Boyer. These are not yet sufficiently numerous to obviate the necessity for other measures. Some pupae collected were infested with a fungus, *Isaria farinosa*. A table summarises the work of parasite introduction. Details of gipsy moth work in various towns are given, the statistics of various localities being included in a table.

BRITTON (W. E.) & ZAPPE (M. P.). **Experiments in Spraying Apple Orchards to control Aphids and False Red-Bug.**—*17th Rept. Connecticut State Entomologist for 1917, Conn. Agric. Expt. Sta., New Haven*, Bull. no. 203, 1918, pp. 259–262, 2 plates.

Lygidea mendax, Reut. (false apple red bug) is prevalent in the south-western counties, and probably occurs throughout the State, doing considerable damage to apple orchards. Among Aphids, *Aphis sorbi* and *A. pomi* are chiefly responsible for injury to fruit. Treatment with nicotine sprays gave considerable success, the results being given in tables. The formula employed was 1 pint Blackleaf 40, $2\frac{1}{2}$ lb. powdered lead arsenate, 2 U.S. gals. commercial lime-sulphur and 100 U.S. gals. water. Treatments were given on 21st May and 4th June. The red-bug injury on the sprayed trees was found to be almost negligible, but Aphids were still present in large numbers. It is hoped to continue the experiments next year, and it is suggested that spraying should be done earlier and that the branches should be thinned to let in more light and air.

LOWRY (Q. S.). **The Striped Cucumber Beetle: *Diabrotica vittata*, F.**—*17th Rept. Connecticut State Entomologist for 1917, Conn. Agric. Expt. Sta., New Haven*, Bull. no. 203, 1918, pp. 262–273, 2 plates, 1 fig.

Diabrotica vittata F. (striped cucumber beetle) has been abundant on cucumbers and squashes and related Cucurbitaceae and has also attacked young peas and beans. The beetles feed from late spring until October; in 1916 the adults practically destroyed the entire crop by attacking the cotyledons as they appeared above ground. The life-history of the various stages is given. The most important parasite is a Tachinid, *Celatoria diabroticae*, Schimer. Certain ground beetles and ants feed on the larvae.

Various methods of control are discussed which have already been reviewed [see this *Review*, Ser. A, v, pp. 370, 529]. The results of experiments indicate the following as the principal means of control:—Protecting young plants with wire netting or mosquito-net covers; spraying with lead arsenate alone or in combination; dusting with lead arsenate, land plaster (gypsum) or air-slaked lime; spraying with lime-sulphur; planting an abundance of seed and then thinning; clean cultivation in the autumn; planting of trap-crops; and the use of fertilizers as a stimulant to growth.

BRITTON (W. E.) & ZAPPE (M. P.). **The Imported Pine Sawfly: *Diprion (Lophyrus) simile*, Hartig.**—*17th Rept. Connecticut State Entomologist for 1917, Conn. Agric. Expt. Sta., New Haven*, Bull. no. 203, 1918, pp. 273–290, 4 plates.

This paper is largely a compilation of various notes that have appeared on the subject of *Diprion (Lophyrus) simile*, Hartig. [See this *Review*, Ser. A, iii, p. 573, iv, pp. 242,286, and v, p. 217.] There are two generations in Connecticut and possibly a third in favourable seasons. The larvae injure pine trees by feeding on the leaves, particularly those of five-needled pines. Winter is passed in the pupal stage on the twigs, and adults begin to emerge in the latter part of April. Eggs are deposited in the needles of the previous season's growth. The first generation of larvae feed during May and early June, those of the second generation during August and September, and the latter feed on the new growth, so that trees may be stripped in one season. After 5 moults the larvae pupate. Eggs may be deposited parthenogenetically and will hatch and develop normally. Nearly 50 per cent. of the larvae are parasitised, the parasites including the Hymenoptera, *Dibrachys nigrocyaneus*, Nort., *Monodontomerus dentipes*, Boh., *Dibrachoides verditer*, Nort., *Delomerista* sp.n., *Cerambycobius* sp. (probably new), *Eurytoma* sp., *Hemiteles utilis*, Nort., and a Dipteron, *Exorista petiolata*, Coq. Of these, the first three give fair promise of becoming effective in checking the pest, the first-named being by far the most abundant. Remedial measures include spraying the trees with lead arsenate early in May and again in August, and destroying the larvae and cocoons when found.

BRITTON (W. E.) & LOWRY (Q. S.). **Outbreak of the Pink and Green Potato Aphid.**—*17th Rept. Connecticut State Entomologist for 1917, Conn. Agric. Expt. Sta., New Haven*, Bull. no. 203, 1918, pp. 290–302, 2 plates, 1 fig.

This paper records an outbreak of *Macrosiphum solanifolii* (pink and green potato Aphid) that occurred in New Haven in July 1918. Investigation and control were carried on on the same lines as in the Ohio outbreak recently described [see this *Review*, Ser. A, vi, p. 455].

ZAPPE (M. P.). **A Cockroach Pest of Greenhouses, *Pycnoscelus (Leucophaea) surinamensis*, L.**—*17th Rept. Connecticut State Entomologist for 1917, Conn. Agric. Expt. Sta., New Haven*, Bull. no. 203, 1918, pp. 302–313, 4 plates.

The cockroach, *Pycnoscelus (Leucophaea) surinamensis*, L., became very numerous in greenhouses in the spring of 1917, causing considerable damage by gnawing the bark from the stems of young rose plants. When full-grown, the insects eat the leaves rather than the bark on the stems. Much damage was done also to Easter lilies, young sprouts from the bulbs as well as large plants being attacked. The bark of *Poinsettia* stems was similarly eaten away. The insects hide during the day in crevices in the benches, walls and floor and under boards or other dark shelter ; at night they come out in large numbers to feed. Eggs are frequently laid in the soil. Very little is known of the reproduction of this species, but it would appear that the young are either born alive or hatch from eggs within 24 hours. From the fact

that over 1,000 individuals examined from one greenhouse proved to be all females, it is probable that the species is parthenogenctic, though this has not been proved.

A number of poisons were used in various combinations in control experiments, but very few of these were found to have any value. Phosphorus paste or borax might hold the insect in check in the case of small infestations. In the present investigations, pure kerosene sprayed along the top and sides of the benches and into holes in the masonry brought out all the insects, which were all killed as they came in contact with the oil. This treatment cleared the house of the insects, but as kerosene scorches foliage, care must be taken not to touch the leaves of the plants with the spray.

ZAPPE (M. P.). **Eradicating the Little House Ant or Pharaoh's Ant from a Dwelling House.**—*17th Rept. Connecticut State Entomologist for 1917, Conn. Agric. Expt. Sta., New Haven,* Bull. no. 203, 1918, pp. 314–315.

A case is recorded of a house badly infested with the small house ant [*Monomorium pharaonis*, L.]. The house was cleared of the insects by means of a poison-bait composed of 1 lb. sugar (or ½ lb.) dissolved in a quart of water, to which is added 125 grains of sodium arsenate. This is boiled until thoroughly dissolved and a tablespoonful of honey is then added. When cool this mixture was used with pieces of sponge on small, shallow dishes, two or three dishes being placed in each room. The bait was renewed two or three times at a few days' interval, and in less than three weeks the ants had all disappeared.

GAUTIER (C.). **Etudes physiologiques et parasitologiques sur les Lépidoptères nuisibles. La Ponte des *Apanteles*, Parasites de *Pieris brassicae*.** [Physiological and Parasitological Studies on Injurious Lepidoptera. Oviposition of *Apanteles* Parasites of *Pieris brassicae*.]—*C. R. Soc. Biol., Paris,* lxxxi, no. 15, 27th July 1918, pp. 801–803.

In a previous paper the author has touched on the question of the probable stage in the life-history of *Pieris brassicae* at which infestation by the Braconid parasite, *Apanteles glomeratus*, occurs [see this *Review*, Ser. A, vi, p. 190]. In order to establish a point on which opinion in the past has been so widely divided the author experimentally reared larvae from eggs of *P. brassicae* taken from a plot of land on which the larvae of the same insect from the age of 24 hours and upwards were found to be parasitised to a very high degree. It was found that not one of the larvae reared in captivity was parasitised, and that all, with the exception of less than 2½ per cent. that died from natural causes, eventually pupated, thus proving conclusively that the parasitisation of *P. brassicae* does not occur during the egg-stage.

ARRIBÁLZAGA (E. L.). **La Langosta voladora de Colombia y Venezuela.** [The winged Locust of Colombia and Venezuela.]—*Physis, Buenos Aires,* iv, no. 16, 15th May 1918, pp. 49–79, 7 figs. [Received 15th August 1918.]

Being of opinion that the determination of the winged locust of Costa Rica and Venezuela as *Schistocerca paranensis* [see this *Review*,

Ser. A, iii, p. 652; iv, p. 92] is erroneous, the author obtained from Trinidad several specimens, undoubtedly belonging to this winged species, which has been variously determined as *S. peregrina*, *S. americana* and *S. paranensis*. These determinations are said to be incorrect, the species being a new one which is described here as *Schistocerca urichi*. This is certainly the locust invading Colombia and Venezuela and is probably the one which invades Central America. The original breeding place probably lies in the highlands of Guatemala or in the plains between Guatemala, Mexico and Belize. It is probably also the species found in Yucatan and believed by d'Hérelle to be *S. americana*, though the author admits that a male example sent him by d'Hérelle does not agree with *S. urichi* and appears to belong to an unindentified species. The sub-permanent regions of distribution of *S. urichi* therefore include Yucatan and the republics of San Salvador and Honduras, while the regions temporarily invaded include the republics of Nicaragua, Costa Rica, Panama, Colombia, Venezuela, northern Ecuador (sometimes), the Guianas, and the northern parts of the Brazilian States of Amazonas and Para. The invasions occur in the dry season, from May to August, and the exodus of the new winged individuals is towards the north or the west (according to the country where they were bred) in order to concentrate in their country of origin. According to existing data the normal time of incubation of the eggs of *S. urichi* is 14 days in Yucatan, 20 in Costa Rica and 25 in Venezuela and the total life-cycle requires 54 days in Yucatan, 76 in Costa Rica and 90 in Venezuela. The newly hatched larva is white in colour, the hopper being reddish and yellowish with black markings.

In an addendum the author remarks that the above paper was completed before he was aware that Rehn had identified the Venezuelan locust as *S. paranensis* and published his finding in March 1913 in the *Proceedings of the Academy of Natural Sciences of Philadelphia* (lxv, pp. 82–113). He points out that Rehn there admitted the occurrence in Venezuela of two different species of migratory *Schistocerca*, for he identified one specimen from that country as *S. peregrina*, Oliv., though he afterwards expressed a contrary opinion. The author concludes by suggesting that this latter specimen should be examined again.

BRÈTHES (J.). **Description d'une nouvelle Dexiinae argentine.** [Description of a new Dexiine from Argentina.]—*Physis, Buenos Aires*, iv, no. 16, 15th May 1918, p. 115. [Received 15th August 1918.]

A fly recently collected at Cordoba is here described as *Hystrichoderia pueyrredoni*. It probably is a parasite of Lepidopterous larvae and therefore beneficial.

GOUGH (L. H.). **Notes on an *Ephestia*, an Insect injurious to stored Dates in Khargeh Oasis.**—Separate, dated 1918, from *Bull. Soc. Entom. d'Egypte, Cairo*, 1917, pp. 133–140, 1 plate. [Received 20th August 1918.]

The date crop of Khargeh Oasis is damaged to a considerable extent each year by larvae of *Ephestia* sp. Investigations in 1917 showed that growing dates are not attacked by these larvae, but only fallen or gathered fruit. The eggs are laid singly or in groups

of 2 or 3 on the surface of dates or any object in the immediate vicinity, semi-dry dates being preferred to dry ones, and hatch on the fourth day if laid in September. The larvae wander actively in search of food and utilise any cavity they can find to hide in when feeding. The calyx end of the date is generally entered, the space between the stone and the flesh of the fruit being occupied by the larva. During September the larvae feed for 20 days or more, they then leave the shelter of the fruit and search for a suitable spot to spin a cocoon, weaving silk threads behind them all the time. After wandering for about 2 days the cocoon is constructed, the minimum time required before emergence of the adult being 5 days in September. Mating takes place soon after emergence and oviposition about 24 hours later. Eggs of unfertilised females have not been known to hatch. It is evident that cold retards development, and larvae hatching in October require a longer period before arriving at maturity, some of them hibernating in this stage. This species of *Ephestia* has chiefly been recorded from dates grown in Khargeh and Dakhleh Oases; dates from the north-east of the Delta were found infested with *E. calidella* and *E. cautella*, the larvae of both these species differing from the Oasis species.

It is suggested that semi-dry dates for export should be graded in two qualities; the first quality to be packed immediately and then at once treated with sulphur dioxide in order to kill any eggs on the fruit. The second quality could be made into pressed dates, most of the larvae being killed during the pounding of the fruit. Dry dates should also be treated with sulphur dioxide or by heat and then stored at once in moth-proof receptacles. Fallen dates should not be allowed to lie about and rot in the date orchards.

Urich (F. W.). **The Black-Eye Pea Weevil.**—*Bull. Dept. Agric., Trinidad & Tobago, Port-of-Spain*, xvii, no. 1, 1918, pp. 14-16, 2 plates. [Received 20th August 1918.]

Bruchus (*Pachymerus*) *quadrimaculatus*, F. (black-eye pea weevil) is the chief cause of damage to black-eye peas, when kept for any length of time in storage. Recently harvested peas seem most liable to attack. The damage is done by the larvae feeding within the peas and is continued by successive generations until the peas become unfit even for the insects to live on. The eggs are laid on the outer skin of the peas when in storage; cases of infestation in the field have not been noticed. The larvae hatch within a week, and eat into the peas, making a small chamber in which they pupate, the adult emerging by a small circular hole. The whole life-cycle occupies about 30 days. The larvae are attacked by a Chalcid which is always found associated with the Bruchids, and which controls them to some extent. As soon as possible after harvesting, peas should be dried and then stored in weevil-proof places. Before being put into storage they should be examined, and if any eggs are found, carbon bisulphide should be used at a strength of 5 lb. to every 1,000 cub. ft. as a fumigant. The liquid should be placed on the top of the peas and the receptacle closed for 24 hours. Peas should be aired after fumigation. Illustrations are given of suitable receptacles for storage. Treating the peas with kerosene oil or salting them is of little use against attack.

INGERSON (H. G.). **The Striped Peach Worm.**—*U.S. Dept. Agric., Washington, D.C.*, Bull. no. 599, 16th March 1918, 16 pp., 4 plates. [Received 20th August 1918.]

Gelechia confusella, Cham. (*persicaeella*, Murt.) (striped peach worm) attacks the foliage of the peach and sand cherry (*Prunus pumila*), the larvae spinning silken webs, usually at the terminals of the branches, causing the leaves to dry up and drop off. Little attention has been paid to this pest; the present bulletin records observations on the life-history in 1915 and 1916, made in open-air insectaries in which glass battery jars were used as rearing cages. There is one complete generation and a partial second in the year. The earliest emergence of moths took place on 22nd May and continued until 14th July, the maximum numbers appearing on 29th June. Eggs were deposited both on the fruit and under the scales surrounding the attachment of the peach to the stem, and on sand cherry under the bud-scales and in the axils of leaves. The average length of life of the adults is 10½ days, though the periods vary considerably. They are not often seen in the field because of their small size and inconspicuous colouring. The incubation period for these eggs varied from 10 to 19 days. Larvae feed from 3 to 6 weeks, but do more damage by enveloping the foliage in their webs than by actual feeding. Cocoons are constructed in the soil at a depth of about ½ inch, and are made of a white silken web enclosed in particles of soil. The average time of pupation is 12 days, the adults of the first generation emerging about 10th August. Oviposition occurs within a few days, the average length of the stages of the second generation being 15 days for the egg and 52 days for the larval feeding period. Some of the larvae of this generation pupate within the webbed foliage, in which case no cocoons are formed. Tables are given showing the duration of various stages of many individuals studied.

Many parasites of *G. confusella* were reared during these studies, including the Ichneumonids, *Angitia discoocellellae*, Vier., which was by far the most numerous, *Cremastus forbesii*, Weed, *Cremastus* sp., and *Epiurus indagator*, Walsh; the Braconids, *Apanteles gelechiae*, Vier., *Ascogaster carpocapsae*, Vier., and *Epirhyssalus atriceps*, Ashm.; the Tachinids, *Exorista pyste*, Wlk., and *Frontina ancilla*, Wlk., which was the most numerous of all the parasites, and the Bombyliid, *Anthrax lateralis*, Say. The occurrence of *G. confusella* may be so local as to permit of the cutting out of the infested terminals as a means of control, and orchards sprayed regularly with arsenicals will seldom show any infestation; but if special spraying should be necessary, a single application of 2 lb. lead arsenate paste or 1 lb. powder to 50 U.S. gals. water to which 2 lb. freshly slaked lime has been added, will satisfactorily control the insect.

BRITTON (W. E.). **Spray Calendar. Insect and Fungous Pests of Cultivated Plants.**—*Connecticut Agric. Expt. Sta., New Haven*, Bull. no. 199, [n. d.], pp. 53–97, numerous figs. [Received 20th August 1918.]

This spray calendar includes brief descriptions, with preventive measures, of such insects as most frequently cause injury to the common plants cultivated in Connecticut and other north-eastern states.

YATES (A. W.). **Beekeeping for Connecticut.**—*Connecticut Agric. Expt. Sta., New Haven,* Entom. Bull. no. 205, April 1918, pp. 425–446, 19 figs.

COLEY (H. W.). **Diseases of Bees: Their Detection and Treatment.**—*Connecticut Agric. Expt. Sta., New Haven,* Bull. Immediate Inf. no. 8, May 1918, 4 pp.

Much useful information for keepers of bees is contained in these bulletins. Various hives with suitable accessories are described, with instructions as to the selection and care of bees, control of swarming, production of honey, etc. The best preventives against, and treatments for bee diseases are also discussed.

QUAINTANCE (A. L.) & SIEGLER (E. H.). **Information for Fruit Growers about Insecticides, Spraying Apparatus, and Important Insect Pests.**—*U.S. Dept. Agric., Washington, D.C.,* Farmers' Bull. no. 908, February 1918, 99 pp., 74 figs. [Received 20th August 1918.]

A short summary of this bulletin states that it contains directions for the preparation and use of the more important insecticides necessary in combating the various insect pests of orchards, vineyards, etc., as well as other information of use in preventing or reducing insect losses in these crops. Various types of spraying apparatus, nozzles, etc. are described and illustrated, with special reference to their use in orchards and home grounds. A ready reference table for the dilution of sprays is given and also a chart showing which sprays may be combined and which plants treated with given sprays. The paper concludes with a discussion of the more important insects attacking the apple, pear, quince, peach, cherry, plum, grape, currant and gooseberry, and gives spraying schedules for the treatment of insects of the apple, peach and grape.

GARMAN (H.). **Orchard Spraying.**—*Kentucky Expt. Sta., 22nd Bien. Rept. Dept. Agric., Labor & Statistics, Lexington,* 1916–1917, 23 pp., 12 figs. [Received 21st August 1918.]

This paper describes the principles of spraying, and enumerates the most useful mixtures for general use, giving formulae for their preparation. The necessary spray machinery is described and a spray calendar for orchards is included.

GARMAN (H.). **Observations and Experiments on the Bean and Pea Weevils in Kentucky.**—*Kentucky Agric. Expt. Sta., Lexington,* Bull. no. 213, December 1917, pp. 309–333, 8 figs. [Received 21st August 1918.]

The beetles found attacking beans and peas in Kentucky include *Bruchus obtectus* (common bean bruchus), *B. quadrimaculatus, B. chinensis* (cowpea bruchus) and *B. pisorum* (pea bruchus). The mild winters in Kentucky render the beetles very troublesome at times, particularly in small quantities of beans and peas stored for home use. The damage done is described, as well as the stages of the insects, which continue to breed throughout the winter in rooms kept at sufficiently high temperatures. It is difficult to destroy these

Bruchids in the field, though lead arsenate, applied during the oviposition period, may destroy the young or deter the adults from ovipositing on the green pods.

As *Bruchus pisorum* has only one brood during the year it has been suggested that simply keeping infested seed peas confined in a bin or in sacks, so that the adults cannot escape, is the only precaution necessary to prevent future injury in the fields. This would be successful, if universally practised. The weevils can, however, all be destroyed in storage by fumigating with carbon bisulphide. This should be done at a temperature of 70° F. or more, one teaspoonful of the liquid being used to each cubic foot of space, reducing the quantity according to the amount of space occupied by the seeds. The liquid should be placed in a small dish on the top of the seeds and the receptacle tightly closed down for not less than 24 hours. The results of experiments with varying quantities, temperatures and times of exposure are given. Dry heat at 122° was found to kill all the adults. A list is given of practicable temperatures and periods for treating cowpeas, wheat, and maize. Low temperatures are fatal to the insects; at zero all stages can be killed by exposing them to that temperature throughout a night. The germination of the seeds is not affected by this treatment. A table shows the effect of low temperatures on the beetles. The effect of carbon bisulphide on the germination of seeds is discussed and a table shows the results of experiments. The use of more than 1 teaspoonful of the liquid to a cubic foot (1 lb. to 83 cub. ft.) was found to be injurious.

Enemies of the cowpea Bruchids include Chalcidids, and the mite, *Pediculoides ventricosus*.

Garman (H.). **Foul-Brood of Bees; its Recognition and Treatment.** —*Kentucky Agric. Expt. Sta., Lexington*, Circ. no. 17, August 1917, pp. 99-106, 3 figs. [Received 21st August 1918.]

In discussing the treatment of foul-brood in this paper, particular stress is laid upon the necessity for transferring infected bees to a movable frame hive, the process being described in detail.

Paull (J.). **White Ants.**—*Jl. Dept. Agric. S. Australia, Adelaide*, xx, no. 10, May 1917, p. 782. [Received 21st August 1918.]

To prevent termites from working their way into a wooden building it is essential that it should be erected upon jarrah or red gum stumps, the ends let into the ground being first well charred with fire and, if possible, tarred. The top of the stumps should be sawn off horizontally at floor-plate level, and a strip of flat galvanised iron, projecting 3 or 4 in. beyond the faces of the stumps all round, secured to them. If the termites then work their way up the stumps, the galvanised iron will stop them. The floor-plates should then be secured to the stumps on top of the galvanised iron. As an additional precaution the floor joists should be treated, especially the ends, with a termite exterminator, also the under-side and joints of flooring boards, bottom lengths of studs, etc. Plenty of light and air must circulate under the building, and on no account should any earth be in contact with the timber.

O'Kane (W. C.), Hadley, Junr. (C. H.) & Osgood (W. A.). **Arsenical Residues after Spraying.**—*New Hampshire Agric. Expt. Sta., Durham, N.H.*, Bull. no. 183, June 1917, 62 pp., 5 figs. [Received 24th August 1918.]

This bulletin records experiments conducted from 1912 to 1916 in order to ascertain the amounts of arsenical residues remaining on fruits and vegetables after spraying with lead arsenate, and the toxic properties of the poison both with regard to persons and stock.

The standard medicinal dose of arsenic is 2 to 5 milligrams. The dangerous dose is quoted as 60 to 120 mg.; there is, however, lack of data for drawing comparison between the toxic properties of arsenic referred to in literature and the possible properties of arsenic in lead arsenate. Experiments detailed in this bulletin show that a single apple might, under extraordinary conditions, retain the equivalent of 4 mg. of white arsenic. The condition of such an apple would be obvious, and ordinary handling of the fruit would be certain to remove an appreciable part of the residue, ·5 mg. being the maximum amount of poison likely to be left on any one apple, taking 3 lb. lead arsenate paste to 50 U.S. gals. water as the usual strength of the spray used. It is believed therefore that under ordinary conditions no apples will reach the consumer carrying such amounts of lead arsenate that a healthy human adult can eat enough at one time to cause fatal poisoning. The case of strawberries is rather different as, owing to the nature of the fruit, larger amounts of the poison might be retained and escape notice, and would be less likely to be rubbed or washed off. The authors are therefore of opinion that strawberries that are fully formed, or nearly so, should not be directly sprayed with lead arsenate unless they are to be thoroughly cleansed before using. For a similar reason, it is suggested that blackberries should not be directly sprayed with lead arsenate after the berries are formed, while currants, if so sprayed, should be well washed. To cabbage or lettuce, ready for market, lead arsenate should be applied only lightly and sparingly, and the outer leaves should be removed and the heads washed before use.

With regard to the effect upon live-stock of feeding upon sprayed grass or upon grass growing beneath sprayed trees and receiving the drips from the trees, experiments indicate that healthy calves may be pastured for a time on grass carrying a considerable amount of spray when the strength of solution used is 3 lb. lead arsenate paste to 50 U.S. gals. water. When the concentration of spray material is increased to 6 lb. of the paste to 50 U.S. gals. water, continued feeding on such grass may result in definite and serious symptoms of poisoning. With 10 lb. lead arsenate to 50 U.S. gals. water, serious or fatal poisoning is likely to follow. The same results seem to apply to sheep. To poultry the danger from lead arsenate poisoning seems to be practically neglible, even if the concentration of the spray material is as high as 10 lb. lead arsenate to 50 U.S. gals. water.

Experiments were carried out to test the possible danger that may lie in feeding live stock upon hay cut beneath trees that have been sprayed. Sixteen days elapsed between the time when the spray was applied and the time when the grass was cut and made into hay. In this period there were heavy rains. Of samples analysed 3 months

later, two showed no recoverable amount of spray material, the third sample showed only a trace. This last was from a plot that had received spray containing 10 lb. lead arsenate to 50 U.S. gals. water.

LUGINBILL (P.). **Contribution to the Knowledge of** *Toxoptera graminum* **in the South.**—*Jl. Agric. Research, Washington, D.C.*, xiv, no. 2, 8th July 1918, pp. 97–110, 1 plate.

Toxoptera graminum, Rond. (spring grain aphis) has hitherto been studied chiefly in the north of the United States, where sexual forms appear annually, and the viviparous ones die off in the autumn. Investigations were therefore conducted from the spring of 1913 to that of 1915, at Columbia, South Carolina, to determine whether *T. graminum* breeds in that latitude viviparously throughout the year, and, if so, for how long a period it breeds in this manner; whether or not the strain becomes weaker as it gets older; and whether or not sexual forms are produced.

The results showed that in the latitude of Columbia oviparous forms are developed and that probably the strain becomes weaker as it grows older, though further investigation is necessary to establish this point.

From a number of experiments it was found that temperature plays an important role in the duration of the instars, there being a gradual decrease in the length of individual instars from March to August, those in March being from 2 to 3 times as long as those in August.

DUDLEY (F. H.) & EATON (S. H.). **The Apple, Tree and Fruit.**—*Maine Dept. Agric. Qrtly. Bull., Augusta*, xvi, no. 2, June 1917, 48 pp., 14 figs., 5 plates. [Received 24th August 1918.]

In the section of this bulletin dealing with spraying, the four usual annual sprays for the commoner apple pests are recommended.

It is noted that one of the insects that cannot be reached by such sprays is the apple maggot [*Rhagoletis pomonella*]. To exterminate this pest, fallen apples should be picked up and destroyed, sheep or pigs should be pastured in the orchard, or a spray consisting of 40 U.S. gals. of calyx spray (lead arsenate, 2 to 3 lb., and lime-sulphur, 1 to 40 U.S. gals.) mixed with 1 U.S. gal. molasses should be used.

RAZZAUTI (A.). **Contributo alla Conoscenza del Tonchio del Fagiuolo (*Acanthoscelides obtectus*, Say, Coleoptera-Bruchidae).** [A Contribution to the Knowledge of the Bean Bruchid, *Bruchus obtectus*.]—Separate, dated 28th September 1917, from *Boll. Lab. Zool. Agrar. R. Scuola Sup. Agric., Portici*, xii, pp. 94–122, 16 figs. [Received 24th August 1918.]

Very little is known concerning the occurrence and injury of *Bruchus* (*Acanthoscelides*) *obtectus*, Say, in Italy, though it has been found there for about twenty years and the province of Pisa is especially badly infested. In the larval stage the seeds of *Phaseolus vulgaris* and *P. multiflorus* are the favourite food, but if these be absent, *Dolichos melanopthalmus*, *Vicia faba*, *Lupinus albus* and *Pisum sativum*

are readily attacked. In certain cases, such as in artificial breeding experiments, *B. obtectus* has adapted itself to maize. In Tuscany four generations were observed in the year. In 1916 the adults of the first generation appeared by 10th August, those of the second by 26th September, those of the third by 30th November. The larvae of the fourth generation appeared from 5th November onwards, and after they had reached maturity in May 1917 the respective adults appeared from 6th to 16th June. As the generations succeed each other rapidly and a single bean seed may be attacked by twenty-five larvae of one generation, the damage is very severe. Even when infestation is slight the beans lose considerably in market value. In some parts of the province of Pisa, and also elsewhere, bean cultivation has had to be given up. Infested beans are unsuitable for seed. In an experiment which was carried out in the spring of 1917, it was found that whereas the percentage of unattacked beans which germinated was 84, that of infested beans was on an average only 23·6. As has already been previously pointed out, plants from infested seed are weak and subject to fungus diseases and give a smaller yield of inferior quality. The only natural enemy of *B. obtectus* known in Italy is the mite, *Pediculoides ventricosus*, Newp., which was present in nearly all infested samples examined, but owing to the dermatitis produced in man by this Acarid, it cannot be encouraged to reduce the numbers of the beetle.

Artificial remedial methods include fumigation with carbon bisulphide and exposure of the infested beans to a temperature of about 60° C. [140° F.]. This latter would seem to be preferable. Exposure to sunlight, immersion in hot water and fumigation with hydrocyanic acid gas are methods of little practical value. The author recommends that farmers should be compelled to fumigate with carbon bisulphide when the adults of the first and second generations appear, and that beans intended for consumption should be placed in an oven when newly gathered. Furthermore disinfected receptacles capable of being tightly closed must be used for storage. Beans required for seed should be taken from lots fumigated with carbon bisulphide.

Dubois (P.). **Les Insectes des Rosiers.** [Insects of Rose-trees.]—*La Vie Agric. et Rur., Paris*, viii, no. 33, 17th August 1918, pp. 118–120, 6 figs.

The insect pests of rose-trees dealt with in this paper include the beetles, *Cetonia aurata, Oxythyrea funesta* (*C. stictica*), *Trichius nobilis* and *T. gallicus*, which eat the petals and stamens. The larvae live in decaying vegetable matter; they are conspicuous owing to their size and consequently are easily destroyed. The weevil, *Anthonomus rubi*, oviposits in June in rose buds and then attacks the flower-stalk, causing the bud to wilt and sometimes to drop. Infested buds, each of which encloses a larva or pupa, should be collected and burnt. The sawfly pests of roses include *Hylotoma rosae* and *Athalia rosarum*. The larvae are destroyed by spraying with petroleum emulsions; 20 lb. black soap, 10 lb. sodium carbonate, and 3 gals. petroleum to 100 gals. water is recommended as a successful mixture. The transformation to the pupal stage takes place in the soil, where the silky cocoons can be found and destroyed. Adults can be caught on plates smeared

with glue and molasses. Other sawflies, such as *Emphytus cinctus*, mine the stems of roses, causing them to wilt and dry up. Such stems should be cut out and burnt. The larvae of *Lyda inanida* roll the leaves and *Rhodites rosae* oviposits in the bark, large galls being formed at these spots; these should be cut out and burnt as soon as they appear.

Lepidopterous pests include *Lasiocampa* (*Bombyx*) *quercus* and *Malacosoma* (*B.*) *neustria*. The eggs of the last-named remain over the winter and should be collected and burnt before the spring. Larvae of *Nygmia phaeorrhoea* (*Liparis chrysorrhoea*), which hatch in September, construct a nest among the leaves. After passing the winter in the nests the larvae recommence feeding, appearing in the spring during the day-time. Collections of the nests should be made during the winter. *Lymantria* (*Liparis*) *dispar* is an equally injurious species. Eggs hatch in May and should be destroyed if possible during the winter. The Noctuids, *Acronycta psi*, *A. rumicis*, *Amphipyra pyramidea*, etc. live on rose-trees without apparently causing much damage. The same may be said of the Geometrids, *Biston hirtarius*, *Phigalia pilosaria*, *Amphidasys betularia*, *Boarmia rhomboidaria*, etc. *Hybernia defolaria*, *H. progemmaria*, and above all, *Cheimatobia brumata*, are more injurious. Banding with some sticky substance prevents the females of the latter from ascending the trees. This should not be applied directly to the bark, but should be spread on paper tied tightly with cord to the main stem of the tree, which should be first protected with straw, moss, etc. The usual formula for banding is 10 oz. white resin, 5 oz. turpentine, 5 oz. linseed oil, 6 oz. olive oil. Another method consists in the use of a box without a bottom which is driven to a depth of a few inches into the ground around the stem of the tree. The upper edges of the box are provided with bands of zinc bent outwards and downwards, so that the females emerging from the ground cannot pass them. These measures are only efficacious from September to December.

Microlepidoptera that are frequently very injurious to rose-trees include *Tortrix bergmanniana*, which is on the wing from July to September. The larvae live at the tips of the young branches, rolling the leaves with fine silken threads and devouring the buds. *Oxygrapha* (*T.*) *contaminata* and *O.* (*T.*) *holmiana* have similar habits. *Coleophora griphipenella* is another leaf-rolling species, as well as some species of *Nepticula*, of which the best-known is *N. anomalella*.

Among Rhynchota, *Typhlocyba rosae* lives on the under-sides of rose leaves, its punctures making yellow markings. The Aphids, *Macrosiphum* (*Siphonophora*) *rosae* and *Myzus rosarum*, are frequently found on roses, the former at the base of the buds, the latter under the leaves. The Coccid, *Aspidiotus rosae*, also occurs. Various formulae are recommended for spraying these insects. Successful results have been obtained with (1) 1 lb. soft-soap, 2 lb. pyrethrum powder, $2\frac{1}{2}$ gals. water; (2) 1 part soft-soap, 1 part amylic alcohol, 10 to 15 parts water, to which a certain quantity of tincture of aloes may be added; (3) 5 pints water, 1 fluid oz. nicotine, 1 oz. sulphur, $\frac{1}{5}$ oz. carbonate of soda, $\frac{1}{5}$ oz. amylic alcohol. The addition of alcohol is recommended in insecticides for bugs and scales, the bodies of which are often greasy or waxy, thus preventing the insecticides from thoroughly wetting them.

La Lutte contre le Puceron lanigère du Pommier. [Control Measures against *Eriosoma lanigerum.*]—*Progrès Agric. Vitic., Montpellier,* xxxv, no. 14, 7th April 1918, pp. 325–329. [Received 24th August 1918.]

This account of the habits of *Eriosoma lanigerum* (woolly apple aphis) and the injury it causes to apple trees concludes with formulae for several insecticides that are recommended for its control.

These are:—(1) Nicotine (10 per cent. strength) ½ gal., soft-soap 5 lb., sodium carbonate (crystals) 1 lb., methylated spirit ½ gal., water 50 gals. The soap is dissolved in the water, and the sodium carbonate in the alcohol, and the two solutions are then mixed together. (2) Potassium carbonate ⅗ oz. dissolved in 5 pints rain water, to which are added successively sodium sulphoricinate or soluble oil, 3 oz., methylated spirit 2 oz., 10 per cent. nicotine 1 oz., the liquid being stirred briskly during the operation. (3) In another formula methylated spirit is the active principle, soap being added to render it adhesive. The proportions are:—Soft-soap 3½ oz., water 5 quarts, methylated spirit or amyl alcohol 9 oz. (4) The alcohol may be replaced by an equal weight of paraffin, according to the formula:—Paraffin 5 pints, soft-soap 2½ lb., water 7½ pints, this being diluted for use with 4 or 5 times its own volume of water. (5) Since the admixture of any kind of seed-oil intensifies and prolongs the action of the the paraffin, another preparation consists of soft-soap 10 lb. dissolved in 8 gals. of hot water, to which, while still hot, ordinary paraffin 5 lb., and seed-oil 7½ lb. are added, the whole being stirred continuously.

All the above preparations must be applied as sprays during the summer only, for fear of injuring the young leaves and shoots. In winter, it is possible to use solutions twice as strong without injuring the trees.

In spring and autumn infested branches may be painted with a mixture composed of:—linseed oil, 14 oz., white lead, 3 oz., zinc white, 2 oz., spirit of turpentine 2 oz. The oil, white lead and zinc white should be boiled together for 10 minutes and, when cold, the turpentine should be added.

In cases where the roots are infested, injections of carbon bisulphide at the rate of 2 oz. to the square yard have proved efficacious. When the main roots only are attacked, it is possible to expose the infected parts in autumn and water them copiously with one of the above-mentioned insecticides.

Degrully (L.). **Traitements contre la Cochylis et l'Eudémis.** [Treatments against *Clysia ambiguella* and *Polychrosis botrana.*]—*Progrès Agric. Vitic., Montpellier,* xxxv, no. 15, 14th April 1918 pp. 337–342, 2 figs. [Received 24th August 1918.]

This paper describes the usual measures against *Clysia ambiguella* and *Polychrosis botrana,* and gives formulae for the preparation of lead arsenate and cupro-arsenical sprays.

Feytaud (J.). **Les Insectes de la Vigne.** [Vine Insects.]—*Rev. Viticulture, Paris,* xlviii, no. 1245, 9th May 1918, pp. 292–295. [Received 24th August 1918.]

This paper reviews the common insect pests of the vine and describes the usual measures for their control.

D'OLIVEIRA (D.). **Un Ennemi de la Vigne en Amérique,** *Polychrosis viteana*, **Clem.** [An Enemy of the Vine in America, *Polychrosis viteana*, Clem.]—*Rev. Viticulture, Paris*, xviii, no. 1249, 6th June 1918, pp. 353–357, 8 figs.

This paper reviews a bulletin on the occurrence and control of *Polychrosis viteana* in America, that has already been noticed [see this *Review*, Ser. A, v, p. 508]. Attention is drawn to this pest in view of the possibility of its introduction into France.*

Use of Prickly Pear Sap in Arsenical Sprays.—*Agric. News, Barbados*, xvii, no. 422, 29th June 1918, p. 195.

Attention is drawn to the value of the sap of the prickly pear [*Opuntia*] in preparing arsenical sprays, which should have the greatest possible adhesive power, so that they may be effective for as long a time as possible and so that the least quantities may be used to obtain the desired results [see this *Review*, A, iii, p. 295]. The stems should be cut into thin slices, in such a way as to ensure the rupture of all the cells containing the adhesive sap, and then put to soak in water.

About 20 lb. of cactus stems are used to about 15 gals. water and the required quantity of the arsenical insecticide added to the solution. This infusion of cactus in water will keep for a long time before its mixture with the poison-spray, if a little copper sulphate be added to it.

The effect is not the same with all insecticides. Zinc arsenate gives the best result, then Paris green, but with lead arsenate or iron salts the results are almost negligible.

LEGISLATION.

Proclamation regarding *Brassolis sophorae*.—*Bull. Dept. Agric. Trinidad & Tobago, Port-of-Spain*, xvii, no. 1, 1918, pp. 52–53.

A proclamation dated 28th March 1918 declares *Brassolis sophorae* (coconut butterfly) to be a pest within the meaning of the Plant Protection Ordinance of 1911.

Amendment to the Regulations under the Destructive Insect and Pest Act.—Order in Council, *Ottawa*, 12th June 1918.

By an Order in Council of 6th June 1918 the importation into Canada of all species and varieties of currants and gooseberries (*Ribes* and *Grossularia*) was prohibited under the Destructive Insect and Pest Act [see this *Review*, Ser. A, v, p. 479]. This order has now been amended to admit species and varieties of currants and gooseberries from that portion of the United States of America west of the line of and excluding the States of Minnesota, Iowa, Missouri, Arkansas, and Louisiana, if accompanied by a certificate signed by the duly authorised State official that such currants and gooseberries have been grown within the State from which they are shipped and are free from insect pests and plant diseases.

*[It is by no means certain that *P. viteana* is a distinct species from the European, *P. botrana*.—ED.]

Bashambar Das (—). **The Aphididae of Lahore. Edited, with Notes and an Introduction by P. van der Goot.**—*Memoirs Indian Museum, Calcutta*, vi, no. 4, March 1918, pp. 135–274, 18 plates. [Received 24th August 1918.]

This monograph on the hitherto little-known Aphids of Lahore deals with 38 species, many of which are new.

These include:—*Pemphigus* (?) *cynodonti*, sp. n., on *Cynodon dactylon* (dub grass); *Macrosiphum rosaeiformis*, sp. n. (Punjab rose aphis) on several species of cultivated roses in gardens; *Stephensonia lahorensis*, gen. et sp. n., on cultivated chrysanthemums; *Brevicoryne coriandri*, gen. et sp. n., on coriander; *Siphocoryne indobrassicae*, sp. n. (Indian mustard.aphis) a serious pest of all the *Brassica* crops, especially mustard and rape; *Toxoptera punjabipyri*, sp. n., on pear (*Pyrus communis*) and a wild variety of pear; *Aphis malvoides*, sp. n., occurring on numerous hosts including *Malva* spp., *Malvestrum* spp., chrysanthemum, pear, pansy and *Solanum* spp.; *A. duranti*, sp. n., on *Duranta* sp., *Colocasia*, etc.; *Brachyunguis harmalae*, gen. et sp. n., on *Peganum harmala*; *B. letsoniae*, sp. n., on *Letsonia scandens*; *B. carthami*, sp. n., on *Carthamus oxycarpi* (wild safflower); *Eichochaitophorus himalayensis*, sp. n., on several species of *Salix*; and *Shivaphis celti*, gen. et sp. n., on *Celtis australis*.

The work concludes with a list of plants attacked, with particulars of the Aphids infesting them, and the time of year when they have been observed. The plates have not been issued with the text, but are to appear later.

Watson (J. R.). **Insects of a Citrus Grove.**—*Univ. Florida Agric. Expt. Sta., Gainesville*, Bull. no. 148, June 1918, pp. 165–267, 67 figs.

This comprehensive bulletin enumerates the insect pests of citrus in Florida. Among the more important of these are the whiteflies, of which the following species occur:—*Dialeurodes citri* (common citrus whitefly), *D. citrifolii* (cloudy-winged whitefly), *Aleurothrixus howardi* (woolly whitefly), *A. floccosa* (flocculent whitefly), *Paraleurodes perseae* (bay whitefly), *Bemesia inconspicua* (sweet-potato whitefly), *Tetraleurodes mori* (mulberry whitefly), and *Trialeurodes floridensis* (guava whitefly); the life-history, parasites, predators and control of the most important of these are given.

Next in importance are scale-insects, 20 species being fully dealt with.

Other pests include the mites, *Tetranychus telarius*, L. (*sexmaculatus*, Riley) and *T. citri*, McGregor; thrips, especially *Frankliniella bispinosus projectus*, Watson; large plant-bugs such as *Nezara viridula*, L., *N. hilaris*, Say, *Euschistus variolarius*, Pal., *Leptoglossus phyllopus*, L., and *Acanthocephala femorata*, F.; the cotton-stainer, *Dysdercus suturellus*, H.-S.; *Ceratitis capitata*, Wied. (Mediterranean fruit-fly); *Pachnaeus opalus*, Oliv. (citrus root-weevil); *Elaphidion inerme*, Newm. (orange sawyer); the butterfly, *Papilio cresphontes*, Cram., of which the larvae of the fourth (and last) generation may entirely defoliate a young tree in a few days, and therefore should be controlled by spraying with lead arsenate, 1 lb. in 50 U.S. gals. water, to which, if there is much new growth, milk of lime obtained by slaking 2 or 3 lb. quicklime

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in a little warm water should be added; *Megalopyge opercularis*, S. & A.; *Phobetron pithecium*, S. & A. (hag moth); the grasshoppers and locusts, *Schistocerca alutacea*, Thunb., *S. serialis*, Thunb., and *Dictyophorus reticulatus*, Thunb.; the katydids, *Cryptophyllus concavus* and *Microcentrum retinerve*; *Oncometopia undata*, F. (orange Jassid); *Trirhabda brevicollis*, Lec. (prickly-ash beetle), the adults of which sometimes defoliate citrus trees; *Aphis gossypii*, Glov. (melon aphis); and *Diabrotica vittata* (striped cucumber-beetle).

Trees which serve as alternative host-plants of citrus insect pests, and which, for this reason, should not be allowed to grow near citrus groves are:—China-berry, prickly ash, privet, and wild olive (*Osmanthus americanus*) (which particularly harbours whiteflies), camphor, croton, oleander and rose.

Sherriffs (W. R.). **Spiders on Tea Bushes.**—*Planters' Chronicle, Bangalore*, xiii, no. 28, 13th July 1918, pp. 465–466.

Damage to tea bushes is reported from Madras due to the presence of a spider, *Stegodyphus sarasinorum*, Karsch, that builds its large colonial webs round the ends of the branches of various bushes, such as *Opuntia* on the plains, and barberry and tea on the hills. Loss to tea-growers results from the webs surrounding the growing points so closely that the development of the buds is arrested. Since the colonies are conspicuous and their growth slow, any serious loss would be the result of sheer neglect.

Andrews (E. A.). **Insect Pests of Tea in North-east India during the Season 1917.**—*Qtrly. Jl. Scient. Dept. Ind. Tea Assoc., Calcutta*, 1918, part 1, 1918, pp. 1–8. [Received 28th August 1918.]

During 1917 the most injurious pests of tea were:—*Helopeltis theivora*, Waterh. (tea mosquito), universally distributed and occurring from May to November; *Empoasca flavescens*, F. (green fly), prevalent in most districts in May and June; *Tetranychus bioculatus*, W.-M. (red spider), in evidence in many districts and reaching a maximum in April and May, being effectively controlled in some districts by coating the leaves with a mixture of lime or sulphur with cowdung and mud, or with a mixture of the last two only; *Heterusia magnifica*, Butl. (red slug), occurring only in small numbers throughout the season; *Biston suppressarius*, Gn., much less troublesome than formerly, the three broods of caterpillars occurring in May, July and September-October; *Clania* spp. (hag-worms), causing only slight damage; *Physothrips setiventris*, Bagn. (common thrips), *Haplothrips tenuipennis*, Bagn. (black thrips), and a new unidentified species from Upper Assam that confines its attacks to the unopened and opening buds; *Thosea* spp. (nettle grubs), in evidence during two periods, January to February and June to July, chiefly on unpruned or lightly pruned bushes.

Other minor pests were:—*Andraca bipunctata*, Wlk. (bunch caterpillar); *Agriophora rhombota*, Meyr. (sandwich caterpillar); *Acanthopsyche reidi*, Watt (limpet caterpillar); *Belippa* spp. (gelatine grub); *Arbela dea*, Swinh., and *A. quadrinotata*, Wlk. (bark-eating borers); *Diapromorpha melanopus*, Lacord. (orange beetle); *Toxoptera coffeae*,

Nietn. (*Ceylonia theaecola*, Buckt.) (tea aphis); *Eriophyes* (*Phytoptus*) *theae*, Watt (pink mite); and termites.

Other pests noticed during the year, but not mentioned in local reports, are:- *Comocritis pieria*, Meyr. (bark-eating borer); *Zeuzera coffeae*, Nietn. (red borer); the scales, *Fiorinia theae*, Green, and *Chionaspis manni*, Green; and the leaf-roller, *Gracilaria theivora*, Wlsm.

FROGGATT (W. W.). **Notes on "Snow Flies" with the Description of a New Species** (*Aleurodes alboflocosa*).—*Agric. Gaz. N.S.W., Sydney*, xxix, no. 6, 3rd June 1918, pp. 434–436, 4 figs.

The whiteflies (ALEURODIDAE) all feed on the sap of plants and there are several cosmopolitan species with a very wide range. *A. vaporariorum*, a European species, is common in Australia, and has been introduced into many parts of the world with hot-house plants. *A. atriplex* is another well-defined species infesting the western bush. *A. alboflocosa*, sp. n., is described from the foliage of *Banksia* and several undetermined scrub trees.

KNOWLES (C. H.). **The Maize Leaf Miner** (*Phytomyza* **sp.**).—*Fiji Dept. Agric., Suva*, Pamphlet no. 27, 28th December 1917, 2 pp. [Received 29th August 1918.]

The species of *Phytomyza* here dealt with was not recorded as a pest of maize prior to 1917, and then the attack was only severe in one district, but it is evident that under certain conditions this miner is capable of affecting maize plants to such an extent as to prevent a crop being raised. Eggs are laid in the upper surface of the maize leaf, generally near the tip and in the young leaves, each egg being deposited singly in a small hole that is first made in the leaf. The larvae upon hatching burrow into and consume the green cellular matter of the leaf, keeping just under the upper epidermis, which dies and shows a white streak indicating the tracks of the larvae. The mines generally run towards the tip of the leaf. When mature, the larvae eat through the thin upper epidermis and escape for pupation. A few pupal cases were found within the larval mines, but this is exceptional. Many pupae were found in the angle between the blade of the leaf and the stem of the plant. As the upper end of the maize leaf hangs downwards it is likely that the larvae upon leaving the food-track fall to the ground, and the soil is probably the normal place for pupation. Two species of Hymenopterous parasites have been reared from the larvae, which are killed before they reach maturity. The larvae of the parasites pupate within the food-track of the host and reach the air by eating through the leaf epidermis. These parasites are so efficient that in ordinary circumstances this maize-miner should be kept under control by them. No treatment can be suggested for destroying the pest. Working the soil at the base of the plants would destroy many pupae, but if the plants are attacked so severely as to warrant such treatment, better results would be obtained by ploughing under the crop and re-planting.

Fullaway (D. T.). Division of Entomology.—*Hawaiian Forester & Agriculturist, Honolulu*, xv, no. 6, June 1918, pp. 157–159.

During the annual period July 1917–1918, no new work was undertaken owing to the War, but the beneficial insects previously introduced were propagated and distributed without interruption, although there is abundant proof of their establishment. The reason for this is that there is a tendency, especially in the case of insects of weak flight, to disappear in isolated districts in the absence of their hosts. Hence it has been the practice to stock new fields of maize with *Paranagrus osborni* (corn leaf-hopper parasite) when the plants were about a foot high, or to use a catch crop to multiply the parasite.

The number of beneficial insects liberated during 1917 was:—Fruit-fly parasites, 16,798; *Spalangia cameroni* (horn-fly parasite), 60; *Opius fletcheri* (melon-fly parasite), 16,815; *Paranagrus osborni* (corn leaf-hopper parasite), 109,611.

The total parasitism of the fruit-fly during the year showed an increase of about 10 per cent., a fact correlated with the greater abundance of some fruits, such as Kona oranges, on the markets.

During the month of April 1918, the insectary handled 20,300 pupae of the melon fly [*Dacus cucurbitae*], from which 1,437 individuals of *Opius fletcheri* were bred and distributed.

Ehrhorn (E. M.). Division of Plant Inspection.—*Hawaiian Forester & Agriculturist, Honolulu*, xv, no. 6, June 1918, pp. 160–165.

During 1917 a new building was erected for the Division of Plant Inspection with fumigation vaults separate from the main building, and equipped with an incinerator.

The usual number of dangerous insects was intercepted during the year, including:—Coleoptera, 17 genera, 20 species; Lepidoptera, 7 genera, 7 species; ants, 7 genera, 10 species; scale-insects, 10 genera, 15 species; Aphids, 4 genera, 4 species.

Among the more important pests met with were:—The Argentine ant [*Iridomyrmex humilis*], discovered on two occasions, while other species that have not as yet gained entrance, together with others already established, were frequently found; a weevil, the larvae of which are very destructive to roots of plants found in the soil of a potted plant from Japan; and bagworms, hitherto unknown in Hawaii, were also found on plants from the Orient.

During April 1918, a package of palm seeds from Egypt was fumigated for an infestation of scale-insects; a case of fruit and ornamental trees from Japan was fumigated owing to the presence of ants in the packing; and a package of orchids from Manila was fumigated for an infestation of ants and scale-insects.

Lichtenstein (J. L.) & Picard (F.). Notes Biologiques sur les Braconides. (Hym.). [Biological Notes on Braconids.] *Bull. Soc. Entom. France, Paris*, 1918, no. 11, 12th June 1918, pp. 172–174. [Received 29th August 1918.]

Glyptomorpha desertor, F., is a parasite of the larvae of *Sphenoptera laticollis*, Ol. (*gemellata*, Mannb.) in the roots of sainfoin (*Onobrychis sativa*, Lam.), and emerges in November. The Braconid larva weaves

a cocoon among the excrement of the host in its gallery, the adult issuing by a circular opening. *Atanycolus sculpturatus*, Thom., a species new to France, emerged in June from larch coming from Hérault, which also harboured numerous individuals of *Chrysobothris solieri*, Lap., which were presumably the host of the Braconid. *Iphiaulax extricator*, Nees, is also obtained from larch from the same district, emerging in May. It is a parasite of Longicorns and probably of *Pogonochaerus fasciculatus*, De G., and *P. perroudi*, Muls. *I. flavator*, F., is a common parasite of *Hesperophanes griseus*, F., in Hérault, the adults emerging in the spring. *Spathius pedestris*, Wesm., has been reared in June from *Anobium striatum*, Oliv., which destroys the old branches of ivy at Montpellier. *S. rubidus*, Rossi, is apparantly also a parasite of Anobiids and almost certainly of Bostrychids, having been reared from vine shoots infested only with *Sinoxylon sexdentatum*, Oliv. It is obtained from other trees that harbour various species of these families, *e.g.*, from olive-trees, harbouring *S. sexdentatum*; fig-trees, harbouring *Sinoxylon* and *Scobicia*; evergreen oak, harbouring *Xylonites praeustus*, Germ.; and from larch, harbouring *Ernobius*. *Caenopachis hartigi*, Ratz., already known as a parasite of *Pityogenes bidentatus*, Hbst., has been reared from branches of larch infested with *P. quadridens*, Htg. *Dendrosoter ferrugineus*, Marsh., is frequently found at Montpellier on shoots of vine and fig infested with *Sinoxylon sexdentatum*, Oliv. *Doryctes leucogaster*, Nees, a parasite of Longicorns, has been reared from larch and from *Quercus ilex* at Montpellier. On the fig, from which it has also been reared, larvae of *Hesperophanes griseus*, F., are undoubtedly its hosts. *D. undulatus*, Ratz., is a parasite of *Magdalis armigera*, Geoffr., occurring on the elm at Montpellier. *Meteorus obfuscator*, Nees, has been reared from *Orchesia micans*, Panz. It was obtained some years ago from a *Polyporus* from Broût-Vernet, emerging some time before numerous individuals of *O. micans*, which were still in the larval state. This confirms the opinion that this Braconid attacks the larvae and not the adults.

LOBO (B.). **A Lagarta rosea da *Gelechia gossypiella*. Os Meios empregados no Egypto para combatel-a.** [The Pink Bollworm, *Pectinophora gossypiella*, and the combative Measures employed in Egypt.]—*A Lavoura, Rio de Janeiro*, xxii, no. 3-4, 1918, pp. 110-131, 1 fig. [Received 27th August 1918.]

This is the text of a lecture on *Pectinophora gossypiella*, against which it is intended to take vigorous measures in Brazil.

Combate á Lagarta rosea. [Measures against the Pink Bollworm.] —*A Lavoura, Rio de Janeiro*, xxii, no. 3-4, 1918, pp. 173-175. [Received 27th August 1918.]

The Brazilian Ministry of Agriculture has founded an organisation for dealing with the pink bollworm [*Pectinophora gossypiella*]. Though the existence of this serious pest was first recorded in Brazil at the end of 1916, energetic measures were unfortunately not taken immediately, and the infestation has spread rapidly.

GRASSI (B.). **La Lotta contro la Fillossera nel Teramano dal 1901 al 1916.** [The Campaign against *Phylloxera* in the Province of Teramo from 1901 to 1916.]—*Boll. Ministeri Agric., Industria, Comm., Lavoro, Rome,* Year XV, ii, Ser. B, no. 9–12, September-December 1916, pp. 69–135, 11 figs., 3 maps. [Received 30th August 1918.]

Except where the altitude is over about 2,000 feet the vine is grown everywhere in the province of Teramo (Abruzzi), the value of the grapes obtained being over £1,000,000. *Phylloxera* was probably introduced about 1890 and a Government campaign was conducted against it from 1901 to 1916. From 1901 to 1903 no less than 90,000 infested stocks were destroyed, as well as 250,000 healthy ones growing near them. The so-called classic or complete method of destruction was adopted without modification until 1906, when changes were introduced with a view to saving expense. In the classic method the stock is cut off about 4 inches above ground and burnt; the stump is split down to the ground and drenched with tar or other insecticides; each square metre of ground is treated with 4 injections of 75–80 grms. each of carbon bisulphide applied at intervals of 3 days, and if thought necessary, the ground is stamped down to ensure the destruction of the stocks; finally the ground is dug up and the stock is removed with all its roots and burnt on the spot.

Of 80 large foci of infestation found in the first three years 78 are now clean or nearly so. As these areas are surrounded by a large expanse of vineyards that have remained quite immune, it may be assumed that the method described above has been successful.

Work on a modified and less efficient plan was continued up to 1916. If it is to be further continued, radical changes will be necessary to ensure real efficiency.

COLLINGE (W. E.). **The Value of Insectivorous Birds.**—*Nature, London,* ci, no. 2543, 25th July 1918, pp. 407–409.

In the British Isles there are only a few species of wild birds that are truly insectivorous in their habits. A great reduction in their numbers has recently been brought about, partly by the severe winters of 1916–17 and 1917–18, and partly by the uniform protection of every species of wild bird, with the result that the loss occasioned by some of these has led to a ruthless war on all species. This state of affairs can only result in the loss of crops and a diminution in the supply of home-grown food.

Of the 280 species of British birds, other than those that are aquatic or littoral in their habits and game birds, rather less than 100 species are insectivorous, and many of these are quite rare.

Beneficial birds include the fieldfare, water ouzel, wheatear, whinchat, stonechat, redstart, robin, warblers and wrens (other than the whitethroat and blackcap), hedge accentor, dipper, tits, wagtails, pipits, flycatchers, swallow, martins, tree-creeper, and finches, other than the greenfinch, chaffinch, house-sparrow and bullfinch, the last two being wholly injurious. None of the buntings are injurious, and all the larks do far more good than harm, while the swift, nightjar, woodpeckers, wryneck, kingfisher, cuckoo, and owls are all most beneficial.

SCHÜTZE (K. T.). *Argyresthia illuminatella*, Z.—*Deutsche Entomologische Zeitschrift "Iris," Dresden*, xxxi, no. 1–2, 1st July 1917, pp. 4–23.

The caterpillar of *Argyresthia illuminatella* infests the ends of the twigs of *Abies alba*, and lives exclusively on this tree, a fact not previously recorded. The attacked branches may be recognised in the autumn by the slightly yellowish-green colour of the needles. The eggs are laid on the buds at the tip of the twigs; the buds are eaten, and from this point the whole twig is completely hollowed out. Pupation takes place in these hollow twigs. Natural enemies of the caterpillar include Ichneumonid parasites and birds.

Argyresthia glabratella lives only in the buds and ends of of the twigs of *Picea excelsa*, *A. certella* exclusively in the end buds of the same tree, and *A. laevigatella* in the ends of the twigs of *Larix decidua*. All these, as well as *A. illuminatella*, are found in the spring, while *Argyresthia praecocella*, which lives only in the berries of *Juniperus communis*, occurs in September.

LANGE (E.). *Agrotis collina*, Bdv., **und ihr Vorkommen im sächsischen Erzgebirge.** [*Agrotis collina*, Bdv., and its Occurrence in the Saxon Erzgebirge (Ore-Mountains).]—*Deutsche Entomologische Zeitschrift "Iris," Dresden*, xxxi, no. 3–4. 1st February 1918, pp. 122–129.

Agrotis collina has a wide distribution and was first noted in Saxony in 1908–10. It is limited to mountainous districts, but is seldom found in the Alps. The caterpillar has been found on raspberry bushes and also in beech-woods of which the undergrowth is composed of wild raspberries, *Sambucus racemosa*, *Solidago fuchsii* and wild lettuce. The caterpillars hide in the dried, rolled-up leaves of these plants and are to be found in them even in very cold weather. They appear at the beginning of May on the young foliage of raspberry bushes and elder trees.

TROOP (J.). **Report of the Entomological Department.**—*Thirtieth Ann. Rept. Purdue Univ. Expt. Sta. for Year ending 30th June 1917, Lafayette, Ind.*, pp. 39–40. [Received 9th August 1918.]

The Hessian fly [*Mayetiola destructor*], which was very destructive to wheat in 1916, was in 1917 held in check by the numerous parasites that had been observed in the previous season, though the jointworm [*Isosoma tritici*] seriously injured the wheat crop in some localities. Aphids were unusually abundant, especially on potatoes. *Papaipema nebris* (*nitela*) (stalk borer) seriously injured potatoes, tomatoes and maize. *Colaspis brunnea* (root-borer) was very active in maize fields, those that had been under timothy grass in the previous year being the worst infested. Potatoes imported into Indianapolis from Australia were found to be badly infested with the potato tuber moth, *Phthorimaea operculella*, which has not previously occurred in Indiana. Growers were at once warned against this pest.

Lees (A. H.). "Reversion" and Resistance to "Big Bud" in Black Currants.—*Ann. App. Biol., London,* v, no. 1, July 1918, pp. 11–27, 6 plates. [Received 5th September 1918.]

"Reversion" in black currants is caused by a check to the normal terminal bud, resulting in its being replaced by a big bud, a killed bud, a blind bud, or a flower bud, this being accompanied by an abnormal amount of growth from lateral buds.

"Big bud" is a disease of black currants due to the attack of mites, which does not kill the growing-point, but stimulates it to make irregular development.

The symptoms characteristic of "reversion" are:—(1) "running off" of the fruit; (2) an unusual amount of lateral wood growth; (3) sharp pointed leaves; and (4) long thin internodes. When caused by the presence of mites, it can obviously be cured only by the elimination of this pest, for which no satisfactory method has yet been devised. Reversion due to Aphids should be curable by pruning away superabundant terminals, at the same time taking care that the bush is making strong growth; while that due to terminal fruit-bud formation is evidence either of faulty pruning, or of the poor condition of the bush as a whole.

The existence of an apparently mite-resistant strain of black currants is explained by the fact that such plants are not really resistant, but in fact so susceptible that the mite kills the growing-point in an attacked bud, thereby cutting off its own supplies and perishing. A few buds however become "big" and serve as a source of infection the following year.

A form of reversion occurring in young bushes before mites or Aphids are present is as yet unexplained.

Taylor (T. H.). Oviposition in the Celery Fly.—*Ann. App. Biol., Cambridge,* v, no. 1, July 1918, pp. 60–61, 1 fig. [Received 5th September 1918.]

The celery fly [*Acidia heraclei*] usually oviposits beneath the epidermis of the under-surface of the leaf. A puncture is made by the ovipositor, which then breaks down the adjacent cell walls, forming a space in which the egg is laid, the process taking about 40 seconds on the lower surface and 50 seconds when the egg is laid from above.

Hatching takes place in about 6 days, the larva emerging through the opposite end of the egg from the puncture. It then burrows forwards, eating out a narrow gallery; after a few days it mines in all directions, producing a cavity that coalesces with other similar ones, thus forming a compound blister containing several larvae. This has given rise to the idea that *A. heraclei* oviposits on the surface, like *Pegomyia* and other blister-making flies, whereas it more closely resembles the Phytomyzidae in its method of oviposition.

Ball (E. D.). The Beet Leafhopper and the Curly-leaf Disease that it transmits.—*Utah Agric. Coll. Expt. Sta., Logan,* Bull. no. 155, June 1917, 56 pp., 5 plates, 6 figs. [Received 2nd September 1918.]

The various investigations that have been carried out with regard to the curly-leaf disease of beets caused by *Eutettix tenella*, Bak. (beet

leafhopper) are reviewed. There is one generation a year and the adult, which hibernates, flies to beet fields in late spring and lays eggs in beet stems until mid-summer. The larvae mature in summer and the adults disappear in early autumn. *E. tenella* is a native insect inhabiting the south-western United States and northern Mexico and extending into the Columbia River region, whence it spreads for hundreds of miles in years of bad infestation. It is found on shadscale (*Atriplex confertifolia*), greasewood (*Sarcobatus*), Russian thistle [*Salsola*], and fine-leaved annual salt-bushes [see this *Review*, Ser. A, vi, p. 418]. Its original food-plant is unknown. Apparently swarms of the insects from wild plants fly from their breeding grounds for long distances and over mountain barriers.

Investigations into the method of transmission of the disease have already been noticed [see this *Review*, Ser. A, v, p. 492]. Factors favourable to curly-leaf development are the presence of large numbers of *E. tenella*, early attack, hot weather and clean cultivation, which results in the elimination of shade for the beets; the converse of these factors, together with frequent cultivation, early irrigation and shade or weeds are unfavourable to the disease. Growing for seed is very uncertain in curly-leaf areas.

Destruction of the hoppers should be effected by pulling a drag over the leaves of the beets and directing a spray at the plants at the moment the hoppers jump to avoid it. The spray should be a 15 per cent. kerosene emulsion. Early planting, which in California is carried out in November and December, eliminates injury to a large extent. Thinning should not be done just when the hoppers are appearing; a knowledge of conditions of the breeding-grounds is useful in predicting possible outbreaks. Parasites of *E. tenella*, to be effective, should be introduced into the permanent breeding grounds. The outlook in certain regions is serious, and it is estimated that during the years 1899–1915 there was a direct loss of £2,000,000 in the United States due to this insect.

SANDERS (J. G.). **Corn Root Aphids Active.** *Wkly. Press Bull. Pennsylvania Dept. Agric., Harrisburg*, iii, no. 33, 15th August 1918.

During July and August many complaints were received from various parts of Pennsylvania of the damage to maize by the corn root aphis [*Aphis maidiradicis*], which is carefully fostered during the winter in the nests of the brown ant. The only satisfactory method of clearing land of this pest is rotation of crops. Maize planted in infested land will have very little chance, but if planted in clean land it will have had such a good start by the time the ants have deposited the Aphids on it that very little harm should be done. If it is absolutely necessary to follow with a second maize crop, the infested land should be deeply ploughed and thoroughly harrowed in the autumn; this will destroy many winter nests of the ants. Besides maize, *A. maidiradicis* attacks broomcorn and sorghum and many uncultivated plants.

Houser (J. S.) The Coccidae of Cuba.—*Ann. Entom. Soc. America, Columbus, Ohio*, xi, no. 2, June 1918, pp. 157–172, 1 plate.

This paper deals mainly with the sub-families Conchaspinae and Diaspinae, and includes a description of *Aspidiotus fabernii*, sp. n., taken on *Faberna* in Havana, and of *A. subsimilis* var. *anonae*, var. nov., taken on *Milliflores verbenacea, Magnolia grandiflora*, rose and other plants in the Botanical gardens at Havana. Keys are given to the species of *Conchaspis* and *Pseudischnaspis*.

Graham (S. A.). An Interesting Habit of a Wax Moth Parasite.—*Ann. Entom. Soc. America, Columbus, Ohio*, xi, no. 2, June 1918, pp. 175–180, 1 plate. [Received 6th September 1918.]

Dibrachys clisiocampae, Fitch, was observed in large numbers issuing from cocoons of the bee moth, *Galleria mellonella*, while the latter were being reared in 1916. Previous records of this parasite give the host as the forest tent caterpillar, *Malacosoma disstria*. In view of its possible value in checking the ravages of the bee moth in stored combs, the life-history has been studied. *G. mellonella* is attacked after spinning the cocoon, usually while still in the larval stage, but occasionally the pupa, while still soft and white, may be attacked. The parasite stabs its victim several or many times with its ovipositor, until the larva within the cocoon is quiescent: several larvae are usually so attacked until they become sluggish and finally die. Eggs are then deposited on the body of the larva, usually in wrinkles in the skin. In 3 to 7 days these hatch and the young parasites immediately fasten themselves to the body of the host and begin to feed. The larval stage usually lasts 2 to 4 weeks or longer. The bodies of larvae of *G. mellonella* were almost invariably attacked by bacteria before the parasitic larvae completed their growth. The parasite required 14 to 25 days for the pupal stage, making a total life-cycle of 31 to 59 days. The females were observed to puncture dead larvae with the ovipositor and carefully draw up parts of the body tissue to the surface of the cocoon and then feed upon it. Since the dead larvae on which *D. clisiocampae* feed are in a state of decomposition and continually changing chemically and physically during the feeding period, it is possible that under proper conditions such parasites could be fed and reared on some animal matter other than insect larvae. This would simplify the problem of finding sufficient suitable food for this, and perhaps certain other parasites.

The habit of killing the host before oviposition is probably common to many of the ecto-parasites among the Chalcidoidea. The larvae of *Pissodes strobi*, Peck (white pine weevil) were always found by the author to be dead when larvae of the Chalcidid parasite, *Eurytoma pissodis*, Gir., occurred on them. The oviposition of this species has not yet been observed. During investigations on *Anthonomus signatus*, Say (strawberry weevil), the eggs of certain Chalcidoid parasites were found only on dead larvae, but at the same time many of the weevil larvae were also dead or dying without apparent cause. This indicates a condition similar to that produced by *D. clisiocampae*. The killing of the host before ovipositing is a decided advantage to such an ecto-parasite, as it ensures the safety of the eggs and larvae from injury that might arise from movements of the host within the cocoon.

HUNTER (W. D.). **The Boll-weevil Problem, with Special Reference to Means of Reducing Damage.**—*U. S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 848, August 1917, 40 pp., 6 figs. [Received 9th September 1918.]

This bulletin deals at length with the history and extent of the invasion of the United States by the cotton boll-weevil [*Anthonomus grandis*], and gives a description and life-history of the pest.

Special emphasis is laid on the following points that have a direct bearing upon control:—(1) The weevil has no food-plant but cotton; (2) the mortality of the weevil during the winter is very high; (3) the emergence from hibernating quarters during the spring is slow and prolonged until well into the summer; (4) early in the season, owing to comparatively low temperatures, its development is much slower than during the summer months; (5) the drying of infested squares soon destroys the immature stages contained therein; (6) the weevil is attacked by many different species of insect enemies; and (7) it has little power of emergence when buried under wet soil.

Following from these facts, the all-important step in boll-weevil control is ploughing under, or uprooting and burning the plants in autumn. Clean cultivation, the early preparation of the land, the early planting of early-maturing varieties with fertilisers where necessary, and the proper spacing of the plants, are also important accessory precautions. Attempts to poison the larva are not advised, unless its attack begins at an abnormally early date in the summer. Special measures for destroying the adult are also useless.

ORTON (W. A.) & CHITTENDEN (F. H.). **Control of Diseases and Insect Enemies of the Home Vegetable Garden.**—*U.S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 856, November 1917, 72 pp., 81 figs. [Received 9th September 1918.]

This bulletin is a popular résumé of the usual control measures employed against the common insect enemies and diseases of home-grown vegetables, which, for ease in reference, are arranged in alphabetical order, each with its peculiar pests and diseases.

CHITTENDEN (F. H.) & ORTON (W. A.). **How to increase the Potato Crop by Spraying.**—*U.S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 868, September 1917, 22 pp., 22 figs. [Received 9th September 1918.]

The insects damaging potatoes dealt with in this bulletin are all leaf-feeders and may be controlled by means of the usual arsenical sprays. In order of importance they comprise:—*Leptinotarsa decemlineata*, Say (Colorado potato beetle), of which both the larvae and adults are destructive; *Epicauta pennsylvanica*, De G., *E. marginata*, F., and *E. vittata*, F. (blister beetles), prompt application of remedies at the very outset of attack being necessary to protect the crop; *Epitrix cucumeris*, Harr., *E. fuscula*, Cr., and *E. parvula*, F. (flea-beetles); *Feltia annexa*, Treit. (cut-worm), the best remedy for which is poisoned bait; and *Empoasca mali*, Le B. (bean leaf-hopper), *Macrosiphum solanifolii*, Ashm. (potato aphis) and *Myzus persicae*, Sulz. (spinach aphis), all of which are readily controlled by spraying with nicotine sulphate.

BISHOPP (F. C.). **The Bollworm or Corn Earworm.**—*U. S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 872, October 1917, 16 pp., 7 figs. [Received 9th September 1918.]

Heliothis obsoleta, F., is one of the most important insect pests of the United States, occurring practically everywhere. The annual loss to the farmer caused by it has been estimated at nearly £6,000,000, owing to the fact that it is a general feeder attacking cotton, maize, tomato, tobacco, garden vegetables, lucerne and cowpeas, as well as many wild plants. This bulletin deals with the life-history of the pest and the nature of the damage caused by it to cotton, maize, tomato and tobacco crops. Cultural methods are advocated as the best means of combating it.

PHILLIPS (W. J.) & FOX (H.). **The Rough-headed Corn-stalk Beetle in the Southern States and its Control.**—*U. S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 875, July 1918, 12 pp., 8 figs.

The Dynastid, *Ligyrus rugiceps*, Lec. (rough-headed corn-stalk beetle) is an insect confined entirely to the southern United States, where it is becoming an increasingly injurious pest, a serious outbreak having occurred in the tidewater section of Virginia in the early summer of 1914. It appears to be limited to poorly-drained lands. Maize is attacked by the adult only, which bores into the very young stalk just below the surface of the ground, eating away the growing-point or bud. Plants about 3 feet in height are not so severely damaged, as the growing-point is then out of reach of the beetles, and full-grown plants are practically immune.

Oviposition occurs in early summer, the eggs being deposited singly, or in groups of 3 or 4 in the ground. They hatch in about two weeks, the rapidly growing larvae reaching their full growth in about two months. The adults emerge in September after a pupal period of about a fortnight, and soon go into hibernation, there being only one generation a year.

The most important remedial measure is the elimination of all old waste and pasture lands, since the favourite, and indeed the only possible breeding place is low, poorly-drained land. This should be thoroughly drained and cultivated with a regular rotation of crops. Maize should not be planted on such land the first year, but since no other crop is injured by this insect, anything else may be substituted. Other accessory measures are early planting, the use of fertilisers, the pasturing of pigs, hand-picking, and autumn ploughing to destroy the pupae.

VAN ZWALUWENBURG (R. H.) & THOMAS (H. E.). **Some Means of controlling Insects, Fungi, and other Pests in Porto Rico.**—*Porto Rico Agric. Expt. Sta., Mayaguez.* Circ no. 17, 27th June 1918, 30 pp. [Received 4th September 1918.]

This paper gives an account of the most generally used insecticides, with formulae for their preparation, describes methods of fumigation and the employment of heat as a means of killing insects, and discusses the compatibility of various insecticides and fungicides.

SMYTH (E. G.). **Report of the Entomological Department.**—*Ann. Rept. Porto Rico Insular Expt. Sta., Rio Piedras, from 1st July 1916 to 30th June 1917;* 1917, pp. 99–106. [Received 10th Sept. 1918.]

The plant quarantine laws of Porto Rico forbid the importation of fresh fruit from any other tropical country or island, with the exception of plantains, which are not considered liable to carry fruit-fly larvae. Plant inspection resulted in the interception of the following pests, mainly from the United States:—Aphids, found in 82 cases on rose, chrysanthemum, carnation and other plants; *Pseudococcus* and other scale-insects, found in 14 parcels on palms, ferns, etc.; red-spider [*Tetranychus*], in 7 cases on rose and carnation; *Phlyctaenia* sp., in 7 cases on chrysanthemum, phlox and salvia; *Tortrix (Archips)* in 2 cases on rose; Geometrids twice on rose; white-fly [*Aleurodes*] on palms; mites on narcissus; ants on orchids; beetles on roses and banana plants; Phycitids twice on mango seeds and apples; *Bruchus (Laria)* in horse-beans; and *Sylvanus* in garlic seed.

Sugar-cane imported from Santo Domingo for grinding has been fumigated owing to the presence there of the Satyrine butterfly, *Calisto archebates*, the caterpillars of which feed upon cane foliage. Other sugar-cane pests that are intercepted annually in large numbers are *Diaprepes quadrivittatus*, Oliv. (Santo Domingo cane weevil root-borer), *Metamasius sericeus*, Oliv., and *Hololepta quadridentata*, F., a large Histerid beetle that appears to infest sugar-cane.

COTTON (R. J.). **Report of the Assistant Entomologist.**—*Ann. Rept. Porto Rico Insular Expt. Sta., Rio Piedras, from 1st July 1916 to 30th June 1917;* 1917, pp. 106–122, 1 plate, 1 fig. [Received 10th September 1918.]

Particular attention was given during the year under review to the insects affecting tobacco, citrus and vegetables. Flea-beetles, which are the worst insect pests of tobacco, are being controlled by the use of lead arsenate, applied in powder form with small dust guns in equal proportions of lead arsenate and dry, leached wood ashes, or undiluted lead arsenate in the case of exceptional outbreaks. As this method is expensive, it is hoped to find a cheaper poison of sufficient strength to kill the insects without scorching the foliage. The systematic use of poisons, the cutting down of weeds, and the planting of another crop such as velvet beans between the tobacco plants, are gradually becoming universal practices and resulting in great benefit.

Pachyzancla periusalis, Wlk. (tobacco leaf-folder) occurs abundantly throughout Porto Rico, especially during the period from October to May, feeding exclusively on Solanaceous plants. Cultivated food-plants include tobacco, egg plant, tomato and several weeds including *Solanum torvum* and *S. nigrum*. Eggs are laid singly on the under-sides of tobacco leaves when the plants are young, and hatch in 5 to 8 days, the larvae immediately beginning to feed on the parenchyma of the leaves. During the next 18 or 20 days the larva moults four times, finally rolling itself into a portion of the leaf which it cuts out and wraps around itself with silk. About three days are thus passed in a pre-pupal state, the true pupal stage lasting a further 12 days, at the end of which the adult moth emerges. Tables are given showing

life-cycles varying from 35 to 44 days. The various generations overlap and all stages of the insect are found abundantly at the same time. Parasites of *P. periusalis* include two unidentified Hymenoptera infesting the eggs. Numerous individuals of the Tachinid, *Argyrophylax albincisa*, Wied., were reared from larvae collected in the field. The Ichneumonid, *Chleonus* sp., was also frequently found parasitising the larvae, and numbers of a small Braconid were reared from the pupae. As the damage is done chiefly when tobacco is young, it comes at a time when most growers are dusting the plants with arsenicals against flea-beetles, and this is a sufficient remedial measure. All wild host-plants growing near tobacco fields should be destroyed, especially the wild egg-plant, *Solanum torvum*.

Dicyphus luridus, Gibson, has only recently been described [see this *Review*, Ser. A, vi, p. 130]. This is a Capsid bug closely related to *D. minimus*, Uhler, which does great damage to tobacco in Florida. It is as yet known only in Porto Rico, where it feeds chiefly on tobacco; it is not uncommon on tomatoes in gardens and lives on related wild Solanaceous plants, occurring abundantly on the weed, *Jatropha gossypifolia*. The eggs are inserted singly in the midrib of the tobacco leaf, and hatch in 6 to 10 days, the young nymphs beginning at once to suck the sap from the leaves. Like other Capsids, these insects occasionally feed upon others, sucking the body juices of any that get caught on the sticky foliage of the tobacco leaves. There are 5 nymphal stages of 3–6 days each, the total life-cycle averaging about 30 days. The damage done by this insect in Porto Roco has not as yet been serious, and if the ground is kept free from the weeds that harbour it, no further control measure should be necessary. *Dicyphus prasinus*, Gibson, also a recently described species [*loc. cit.*] is very similar to *D. luridus*, but is rather less abundant on tobacco and and rather more frequently found on tomato. The life-histories of the two species and the damage done to tobacco are practically identical.

Vegetable pests have given considerable trouble during the year and a bulletin describing these is in course of preparation. *Plutella maculipennis* (diamond-back moth) has been very abundant, the larvae damaging cabbage leaves. A spray of 3 lb. lead arsenate to 50 U.S. gals. water is an efficient control if used regularly; if the caterpillars become very numerous, they should be destroyed by spraying with kerosene emulsion.

The usual citrus pests occurred during the year. Damage to the fruit by red spiders and rust mites can be avoided by spraying the trees, as soon as the mites appear, with lime-sulphur 1 : 50 or 1 : 75, with the addition of flour paste, using 4 lb. flour to each 100 U.S. gals. of spray. *Diaprepes spengleri*, which destroys the foliage of citrus trees, frequently congregates in large numbers in restricted sections of a citrus grove and can then be collected by shaking the weevils from the trees into strips of canvas. When they occur uniformly throughout a grove, a spray of 5 lb. lead arsenate to 50 U.S. gals. water should be used. *Solenopsis geminata* (brown ant) forms nests at the base of young citrus trees and chews the tender young branches, frequently causing them to die. The nests should be thoroughly sprayed on two consecutive days with ½ lb. caustic potash or fish-oil soap dissolved in water, with the addition of 1 pint crude carbolic

acid and then sufficient water to make 2 quarts. This should be used in the strength 1 pint of stock to 6 U.S. gals. water. Poison-baits for the ants have not proved satisfactory. Caterpillars of *Papilio androgeus*, Cram., and of *Eantis thraso*, Hbn., have been fairly numerous, but neither species caused appreciable damage.

It is pointed out that the failure in many cases to obtain a good oil-emulsion has been entirely due to the kind of soap used. Owing to scarcity of potash the composition of the common commercial soaps has been changed and these are apt to solidify in an emulsion within a few hours, rendering the spray worthless. As a result of experiments it has been found that an excellent emulsion can be made with ordinary hard, fish-oil soap, that will remain a good liquid for several days, by the following method:—Eight pounds of octagon or fish-oil soap are dissolved in 2 U.S. gals. water by heating; while still hot, 2 U.S. gals. Corvus oil should be slowly stirred in so that a good emulsion is obtained; ¼ lb. ordinary cooking flour is then stirred in, 4 U.S. gals. water are added and the whole mixture heated again until it boils. After removing from the fire, one quart of crude carbolic acid is added and the solution is then ready for use. For spraying, this stock should be diluted at the rate of 1 part to 25 of water.

TURNER (W. B.). **Female Lepidoptera at Light Traps.**—*Jl. Agric. Research, Washington, D.C.*, xiv, no. 3, 15th July 1918, pp. 135–149. [Received 10th September 1918.]

As a test of the generally accepted theory that in the case of Lepidoptera taken at light-traps practically all individuals captured are males and that the few females taken have all previously oviposited, the author conducted a series of observations at Maryland during 1916.

A brief account is given of the methods employed to obtain material and a summary of the facts deduced from examination of the results. A table shows the percentages of the males captured including the following species: *Apantesis vittata*, F., 98; *A. arge*, Drury, 87; *Estigmene acraea*, Drury, 85; *Diacrisia virginica*, F., 88; *Isia isabella*, A. & S., 86; *Halisidota tessellaris*, A. & S., 70; *Datana ministra*, Drury, 71; *Phytometra (Autographa) biloba*, Stephens, 95; *P. (A.) simplex*, Gn., 76; *Meliana diffusa*, Wlk., 89; *Polia renigera*, Stephens, 71; *Caenurgia erechtea*, Cr., 64; *C. crassiuscula*, Haw., 64½; *Cirphis unipuncta*, Haw., 56½; *Agrotis (Noctua) c-nigrum*, L., 47; and *Feltia* spp., probably including *F. subgothica*, Haw., *F. annexa*, *F. gladiaria*, Morr., and *F. jaculifera*, Gn., 72. Of 11,222 moths examined, 71½ per cent. were males: only in one species, *Agrotis c-nigrum*, did the females equal or exceed the males. Of a total of 3,197 females captured, 58 per cent. were gravid, or 16·6 per cent. of the total number of moths examined. A great deal of information has also been gathered from various records of other observers upon this question; this is summarised in a table showing that out of 28,094 individuals, males constituted 55 per cent. and females 45 per cent.

If it be assumed that the sexes exist in nature in approximately equal numbers, the investigations on which this paper is based are

said to show that the females taken at the light trap constitute 57 per cent. of the assumed total of females, while the gravid females so taken amount to 33 per cent.*

It is believed by the author that further investigations will adduce additional evidence to disprove the generally accepted theories on this question.

COTTE (J.). **The Value of the Coleopteron,** *Chilocorus bipustulatus,* **as a Destroyer of Scale-Insects.**—*Bull. Soc. Path. Végétale France, Paris,* iv, no. 2, 1917, pp. 86–88. (Abstract in *Mthly. Bull. Agric. Intell. & Pl. Dis., Rome,* ix, no. 7, July 1918, pp. 901–902.) [Received 10th September 1918.]

Observations on the Coccinellid, *Chilocorus bipustulatus,* as an enemy of *Chrysomphalus dictyospermi,* Morg., which is becoming a serious pest in eastern Provence, show that while the scale is undoubtedly attacked by this beetle, it is not the preferred food. It was found that *C. dictyospermi* continued to maintain itself on a mandarin tree in company with *Chilocorus bipustulatus,* while the Aphid, *Toxoptera aurantii.* Boyer, which tried to establish itself on the tree, was repeatedly exterminated by the Coccinellid. *Saissetia oleae,* Bern., and *Pseudococcus adonidum,* L., were similarly little affected by *Chilocorus bipustulatus,* and it is evident that in the Nice district this beetle cannot be relied upon for efficient control of *Chrysomphalus dictyospermi,* when the latter is present in large numbers.

DEL GUERCIO (G.). *Dysdercus scassellati,* **sp. n., a Bug observed on Cotton in Southern Italian Somaliland.**—*L'Agricoltura Coloniale, Florence,* xii, no. 1, 1918, pp. 5–20, 6 figs. (Abstract in *Mthly. Bull. Agric. Intell. & Pl. Dis., Rome,* ix, no. 7, July 1918, pp. 902–903.) [Received 10th September 1918.]

This paper describes a new cotton-stainer, *Dysdercus scassellati,* from southern Italian Somaliland.

DE STEFANI (T.). *Megastigmus ballestrerii,* **a Hymenopteron living on the Pistachio Tree and Turpentine Tree in Sicily.**—*Boll. Studi Informazioni R. Giardino Coloniale di Palermo,* iv, no. 1–2, 1917, pp. 101–131, 24 figs. (Abstract in *Mthly. Bull. Agric. Intell. & Pl. Dis., Rome,* ix, no. 7, July 1918, p. 903.) [Received 10th September 1918.]

This paper reviews the various insect and Arachnid pests attacking the pistachio tree (*Pistacia vera*) and the turpentine tree (*P. terebinthus*) in Sicily, and gives a detailed account of the Chalcid, *Megastigmus ballestrerii,* Rond. The larva destroys the pistachio seed and in 1916 caused a loss of more than 70 per cent. in some plantations. The

* [This deduction from the figures given appears to be incorrect, since the assumed total of females cannot properly be taken as half the total of the individuals (11,222) captured in the author's experiments. He actually caught 8,025 males, and on his own reasoning he must assume the theoretically available females to be 8,025 and not 5,611 ; this would reduce his percentages of 57 and 33 to 40 and 23 respectively.—ED.]

morphology of the insect is described, with information as to its biology and habits. The author believes that its natural host is the turpentine tree and that it has gradually adapted itself to the pistachio. The method recommended for control of *M. ballestrerii* is the collection and burning of all infested pistachio fruit either on the plant or on the ground. All turpentine trees in or near pistachio plantations should be dealt with in the same manner, the quickest and most certain method in this case being the destruction of the female inflorescences in April and May.

Ballou (H. A.). **Feeding Habits of the Parasites of Hardback Grubs.**—*Agric. News, Barbados*, xvii, no. 425, 10th August 1918, pp. 250–251.

This article reviews the literature on the subject of parasites of hardback grubs. With regard to the parasitism of *Oryctes tarandus* by Scoliid wasps introduced into Mauritius from Madagascar, it is pointed out that the difference between the method of feeding of the larvae and adults of these parasitic insects is of interest. While the actual feeding of the larva causing the death of some agricultural pest is rightly considered of great importance in estimating the work of the parasite, the very different habits of feeding on the part of the adults must be taken into account in any attempt to introduce these insects from one country into another, or to distribute them from one locality to another in the same country. The varied feeding habits of the adults of nearly related species make it necessary to study each species separately in this respect. The question of parasite introduction is now recognised as involving much more than the mere transportation of the adults from one place to another and liberating them in good condition.

The Japanese Beetle in New Jersey.—*Science, Lancaster, Pa.*, xlvii, no. 1234, 23rd August 1918, pp. 185–186.

As the result of infestations by the Japanese beetle [*Adoretus umbrosus tenuimaculatus*] in parts of New Jersey, a quarantine is proposed in order to prohibit the shipment from this territory of green sugar-corn, ripe tomatoes and ripe peaches.

This beetle, introduced during the last 5 or 6 years in soil round the roots of iris, presumably from Japan, has thoroughly established itself, the area of infestation involving approximately 25,000 acres. It is a general feeder, attacking the grape, peach, plum, apple and cherry, as well as many ornamental plants, and feeding freely on a variety of weeds. It also injures the sweet potato and other vegetable crops, especially sweet corn, the beetles penetrating into the tips of the ears, in a similar manner to the common corn ear-worm [*Heliothis obsoleta*], thus rendering possible its easy and wide distribution.

Ball (E. D.). **Leaf Burn of the Potato and its Relation to the Potato Leaf-Hopper.**—*Science, Lancaster, Pa.*, xlviii, no. 1234. 23rd August 1918, p. 194.

A careful study of the potato-growing areas in the northern part of the United States, where there has recently been a remarkable

outbreak of leaf-burn, has shown that in every case the injury was in direct proportion to the number of leaf-hoppers (*Empoasca mali*, Le B.) present. The nymphs, feeding on the under-sides of the leaves, first produce a wrinkling of the whole surface, with a slight upward rolling of the margin, and then the marginal burning appears.

In cage experiments, typical leaf-burn was produced in 4 days, the marginal burn being often so definite as to suggest the injection of some substance, rather than the mere mechanical extraction of the sap.

CARR (E. G.). **An Unusual Disease of Honey Bees.**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 4, August 1918, pp. 347–351.

A disease, first brought to the notice of the Department of Apiary Inspection in June 1915, appeared in 1917 in an alarming manner in well kept apiaries in New Jersey and many other States. as well as in Canada.

The disease, which resulted in the death of thousands of bees of a good stock, was at first thought to be due to poisoning from a contaminated watering place, but no definite conclusions were reached. The abdominal contents of affected bees were found to be watery and to give off an unpleasant, somewhat pungent odour, workers, drones, and even queens being similarly affected. The conditions characteristic of the bee disorder known as paralysis were absent, and the brood within the hives appeared to be healthy. An abnormal condition in the hives was the great abundance of stored pollen and the unusually small amount of unsealed honey in the combs. From this fact, and from the fact that the appearance of the disease coincided with a period of dull weather, while ensuing fine weather caused its disappearance, it was believed that the bees were suffering from a digestive disturbance caused by a diet containing an excess of nitrogenous matter.

The striking similarity between the symptoms of this disease and those of Isle of Wight disease, thought to be caused by *Nosema apis*, which also affects the digestive system, further supports the theory that this disease is due to improper feeding and is thus preventable.

PADDOCK (F. B.). **Foul Brood Eradication Work in Texas.**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 4, August 1918, pp. 351–353.

The foul-brood inspection service established in Texas under the law passed in 1913 has resulted in a state-wide co-operation among beekeepers and a general improvement of 50 to 75 per cent. in the efficiency of the industry. In some few counties foul-brood has been eliminated, and in many more the disease will be stamped out in a very short time.

HOLLAND (E. B.) & BUCKLEY (J. P.). **Calcium Arsenite and Arsenate as Insecticides.**—*Jl. Econ. Entom., Concord, N.H*, xi, no. 4, August 1918, pp. 354–357.

The present intensive production of orchard and garden crops tends towards a maximum consumption of arsenicals in combating leaf-eating insects, with a corresponding scarcity of lead arsenate. The

result of this will be the appearance on the market of cheaper and less reliable arsenicals, such as calcium arsenite and calcium arsenate. The requisites for an insecticide that is to be applied as a spray are:—toxicity to the insect and non-toxicity to the plant; adhesiveness under all weather conditions: fineness of particles and low specific gravity to ensure a high power of suspension and uniform distribution; ability to indicate the leaf-surface covered; and reasonable cost. All arsenical compounds are poisonous, though, as a rule, the lower, or arsenite salts are more active than the higher, or arsenate ones. Arsenic that is soluble in water, or that has been rendered soluble by atmospheric agents, has a corrosive action on foliage to the extent of entire defoliation in severe cases. Therefore an arsenical must be insoluble and stable in water or in whatever liquid vehicle is used for its application.

These conditions are fulfilled by calcium arsenite, which, with excess of lime, has a good power of suspension, and by the deposition of a white film readily indicates the leaf-surface covered.

The use of sodium arsenite, on the other hand, by inexperienced persons cannot be recommended, owing to its solubility.

Acid calcium arsenate is soluble in water but practically insoluble in lime water, which indicates that its safe application necessitates an admixture with Bordeaux or strong milk of lime. It contains a high percentage of arsenic, and may serve in many instances as a substitute for acid lead arsenate during the present emergency. Experiments to test its efficiency are in progress.

MOORE (W.). **Fumigation with Chlorpicrin.**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 4, August 1918, pp. 357–362.

The fact that chlorpicrin, though rather a volatile compound, is extremely toxic to insects [see this *Review*, Ser. B, v, p. 174] has raised the question of its possible use in the fumigation of grain and clothing. Its value as a fumigant for destroying the body louse (*Pediculus humanus*) and its eggs has also been recorded [see this *Review*, Ser. B, vi, p. 189].

The advantages in the use of chlorpicrin, as compared with carbon bisulphide, are:—that its toxicity, molecule for molecule, is about 283 times as great as that of carbon bisulphide; its use, unlike that of the highly inflammable carbon bisulphide, is not dangerous under normal conditions, though it, too, may be exploded when heated; owing to the severe irritation caused to the eyes, nose, and throat by minute quantities, there is very little risk of an injurious amount being inhaled, while carbon bisulphide, though unpleasant, may be inhaled in sufficient quantities to cause death; its vapour, being about twice as heavy as that of carbon bisulphide, which, in its turn is about 2·5 times heavier than air, is particularly suitable for the fumigation of grain owing to its being able to sink down through large masses.

Experiments on the last point have proved that one half pound of chlorpicrin per 1,000 cubic feet will prove destructive to *Bruchus obtectus*, Say (bean Bruchid), *Sitotroga cerealella*, Oliv. (Angoumois grain moth), *Plodia interpunctella*, Hb. (Indian meal moth), and *Ephestia kühniella*, Zell. (Mediterranean flour moth), but is not sufficient

to kill *Tribolium confusum*, Duv. (confused flour beetle) at greater depths in the flour than one inch. For this beetle it is necessary to use as much as 1 to 2 lb. per 1,000 cubic feet. To obtain similar results with carbon bisulphide in fumigation boxes from 3 to 8 lb. at a temperature above 65° F. must be used, while chlorpicrin gives good results at a temperature below 60° F. The experiments also proved that chlorpicrin is more likely to cause injury to germination than is carbon bisulphide, but that no injury results from normal doses if the grain is dry and is thoroughly aired after fumigation. It is able to penetrate through fifty-pound sacks of flour in twenty-four hours at a temperature of 70°, killing all the insects, but exerting a slightly injurious influence on the baking qualities of the flour. When free from impurities of chlorine and nitrogen peroxide, chlorpicrin will not injure dress fabrics or affect their colour.

Although at present unobtainable, it is expected that after the War chlorpicrin will be retailed at a lower price than carbon bisulphide, and though it can never be used on a large scale owing to its irritating properties, it may prove of value for the fumigation of small quantities of grain or seeds and of grain samples, for the destruction of ant nests, etc., and in small doses against mosquitos in yellow fever regions.

PARKER (J. R.). **The Life-History and Habits of** *Chloropisca glabra*, **Meig., a Predaceous Oscinid (Chloropid).**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 4, August 1918, pp. 368–380, 1 fig.

The fact that the larva of *Chloropisca glabra*, Meig., is predaceous upon the Aphid, *Pemphigus betae*, Doane, is of interest, not only on account of its economic importance, but because it constitutes a habit new to the vegetable-feeding family OSCINIDAE. Forms showing the transition from vegetable to animal feeding are *Gaurax anchora*, the larvae of which feed upon moulted insect skins, and *Botanobia darlingtoniae*, the larvae of which feed upon the dead bodies of insect victims of the pitcher-plant.

Chloropisca glabra, of which *Chlorops assimilis*, Macq., is now considered a synonym, is a very abundant species throughout North America; it also occurs in Europe, Africa, and South America.

The adults emerge from over-wintering puparia during May and early in June, and seek grassy or weedy places, being specially attracted to those that are slightly shaded, though many can be seen crawling over the foliage of shrubs and trees. Pairing does not take place till the first week in July, and oviposition occurs towards the end of the same month. The eggs are laid singly, being deposited in cracks in the soil around the base of sugar-beet plants and *Chenopodium album*, only occasionally being found attached to the stem of the plant. The females, in selecting plants around which to oviposit, show remarkable ability in picking out the plants infested with root-aphids. The incubation period is from 3 to 5 days, and possibly longer during cold, wet weather. The larvae are extremely sensitive to light and external disturbance, and hence have never been observed feeding on root-aphids in the field. In the laboratory it was found that only full-grown or nearly mature Aphids were attacked, the soft body contents being sucked out till only the empty skin remained.

Pupation is preceded by inactivity and a shortening of the body,

the larval skin not being shed, but becoming the outer covering of the puparium, the process being completed in about 36 hours. The pupal period generally lasts for about nine months, beginning some time in August, it being in this stage that the insect hibernates. There is only one annual brood, though in warmer parts of the country and at lower altitudes it is quite probable that *C. glabra* is double-brooded.

It is certain that *C. glabra* is by far the most effective insect enemy of *Pemphigus betae*, the worst pest of sugar-beet in Montana, its larvae acting as a very important check and in many instances destroying entire colonies.

FELT (E. P.). **New Gall Midges (Dipt.).**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 4, August 1918, pp. 380–384.

The species dealt with in this paper include :- *Thecodiplosis cockerelli*, sp. n., widely distributed in Colorado and forming irregular enlargements of the needles of *Pinus edulis*; *Mycodiplosis packardi*, sp. n., and *Retinodiplosis albitarsis*, sp. n., reared from *Pinus strobus* infested with *Parharmonia pini*.

DRAKE (C. J.). **A New Corn Insect from California (Heteroptera).**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 4, August 1918, p. 385.

Corythuca essigi, sp. n., a Tingid or lace-bug infesting maize (*Zea mays*), the leaves of which are injured by both nymphs and adults, is here described. An allied species, *C. distincta*, O. & D., has been recorded in Montana upon maize, lettuce, parsnip, beans, lupins, turnip, squash and *Balsamorrhiza*, and in Utah upon *Carduus lanceolatus*.

FELT (E. P.). **Apple Tent Caterpillar Parasites.**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 4, August 1918, p. 386.

Cocoons taken from a nest of the apple tent caterpillar [*Malacosoma americana*] proved to be those of *Amorphota orgyiae*, How., and the parasite reared from them *Otacustes periliti*, Ashm. Both these species have previously been recorded as parasitising *Hemerocampa leucostigma*, S. & A.

PARKS (H. B.). **Notes on *Eleodes tricostata*, Say.**—*Jl. Econ. Entom., Concord, N.H.*, xi, no. 4, August 1918, p. 388.

An infestation in the spring of 1918, which reached a maximum at the end of April, proved to be due to *Eleodes tricostata* [see this *Review*, Ser. A, vi, p. 307]. The injury caused by the larva, while generally resembling that of cutworms, also consists in the cutting off of the buds and leaf-stalks of large plants. The crops most severely attacked are :- Radishes, cabbages, onions, tomatoes, potatoes, maize, and sugar-cane.

Most gardeners have been satisfied with the results obtained from the use of poisoned bran mash, Paris green giving better results than lead arsenate. The adults may be found in old or heavily pastured fields, from two to a dozen or more under each pile of dry manure, giving rise to the idea that this pest may be introduced with barnyard

manure. The adults have a peculiar habit of sunning themselves on ant-hills during the warm days of winter, pointing to the existence of some connection between this beetle and ants, the adults being always more abundant near ant-hills than elsewhere. The larva works at night and on cloudy days and owing to its voracious appetite and omnivorous habits it has been called the Kaiser worm in central Texas.

A Manual of Dangerous Insects likely to be introduced in the United States through Importations.—*U.S. Dept. Agric., Washington, D.C.*, 15th August 1917, 256 pp., 50 plates, 107 figs. [Received 16th September 1918.]

This valuable manual, which is edited by W. Dwight Pierce, has been prepared by the U.S. Bureau of Entomology at the request of and in co-operation with the Federal Horticultural Board, to supply such information as is required by its officers and others in the enforcement of quarantines and the safeguarding of the country against foreign insect pests. The plants yielding vegetable products are arranged alphabetically under the American common name, with the scientific name attached, and a brief sketch is given of each of the more important insects attacking these. It is pointed out that inspectors should not attempt to make final determinations by the use of this work; the book merely indicates the insects likely to be found with importations. References are given under each species to such foreign literature as affords the best or most easily available source of additional information. Inspectors finding important insects not already familar to them are requested to transmit specimens immediately to the Bureau of Entomology at Washington. The scientific names used throughout the manual are those current in European literature, though many of these will undoubtedly be changed as the result of future studies.* A list is given of over 100 important insect pests that have been introduced in the past; many hundreds more are mentioned that are liable to be introduced at any time. The lists of insects included in the manual are necessarily incomplete; many important introduced species are omitted because they are now so generally distributed that the importation of a few additional individuals will have no effect upon existing economic conditions. Frequently the literature on dangerous species is so meagre as to make it impossible to determine the importance of the pest. The handbook is well illustrated.

JONES (T. H.). **The Southern Green Plant-Bug.**—*U.S. Dept. Agric., Washington, D.C.*, Bull. no. 689, 30th July 1918, 27 pp., 14 figs.

Nezara viridula, L., known in Louisiana as the southern green plant-bug, severely injures various vegetable and cultivated crops in the southern portion of the cotton belt of the United States, particularly attacking tomato, beans, potato, sweet potato, okra,

* [The generic name *Mylabris*, Geoffr., is used in this work for the pea and bean Bruchids, but this is incorrect; Geoffroy in his 1762 edition did not adopt the binomial system of nomenclature and his names cannot be accepted. *Mylabris*, F., should properly be applied to the blister beetles.—ED.]

mustard and turnip. Young shoots and developing fruit are injured by the adults and nymphs, which puncture the plant tissues and extract the juices. Eggs are laid in clusters on the under-side of the leaves, the incubation period in the insectary being 5 days. There are five nymphal stages, development during the summer being more rapid than in autumn. Eggs have been found in the field in Louisiana as early as 13th April, and as late as 8th November; and in that latitude four generations may develop in a year. Adults are found hibernating during the winter months, but also occur in the field during mild weather. The Tachinid, *Trichopoda pennipes*, F., was found to be parasitising about 25 per cent. of the adults of *N. viridula* collected. Occasional instances have been observed of *N. viridula* being preyed upon by the Pentatomids, *Podisus maculiventris*, Say, and *Euthyrhynchus floridanus*, L., and by the Bembecid wasp, *Bicytes quadrifasciata*, Say.

Contact insecticides, in order to be effective against *N. viridula*, have to be used in such strength that injury to the plants is very likely to result. It is considered that hand-picking is the most satisfactory control measure when valuable vegetable crops are severely attacked. As adults are frequently found congregating on turnip and mustard in late autumn, it is suggested that these or similar plants might serve as a trap-crop.

The Small Cabbage Moth.—*Queensland Agric. Jl., Brisbane*, ix, no. 6, June 1918, pp. 204-206, 6 figs. [Received 12th September 1918.]

This paper deals fully with the life-history of and remedies against the cabbage moth [*Plutella maculipennis*] in the hope of a united effort being made to limit its ever-increasing numbers.

The insecticide most strongly recommended consists of:—Gas or coal tar 1 gal., soap 2 lb., water 180 gals.; or if required for use in small quantities, the formula may read:—Gas or coal tar, 1½, or ¾ or ½ bottle; soap, 9 or 5 or 2½ oz.; water, 50, or 25 or 10 gals. It is best to spray with this mixture when it is freshly made, care being taken to reach the under-sides of the leaves.

ILLINGWORTH (J. F.) & JARVIS (E.). **Predaceous Enemies of the Sugar-Cane and their Parasites.**—*Queensland Agric. Jl., Brisbane*, ix, no. 6, June 1918, pp. 229–230. [Received 12th September 1918.]

Cultural measures recommended against the sugar-cane grub [*Lepidiota albohirta*] are:—(1) cultivation of the cane during summer weather, followed immediately by ploughing the cultivated areas; (2) late planting and persistent cultivation during the period of oviposition and for a few weeks subsequent to the disappearance of the beetles; (3) ploughing or fallowing land in December; and (4) covering the ground densely with Mauritius beans during the flight of the beetles.

An enemy previously reported as preying on grubs of *L. frenchi* is probably a species of *Phascologale*. From the analysis of stomach contents of the bandicoot it is probable that it is another such enemy, and not, as is sometimes supposed, a source of damage to cane stools.

From information received from the Queensland Museum it is stated that the common digger-wasp, hitherto known as *Dielis formosa*,

has been identified by Mr. R. E. Turner as *Campsomeris tasmaniensis*, Sauss., the true *D. formosa* not occurring south of Cairns. The cane-grubs parasitised by both *Campsomeris radula* and *C. tasmaniensis* are chiefly those of *L. albohirta*, additional hosts being *Anoplognathus boisduvali*, *Lepidiota frenchi*, *L. rothei* and *L. caudata*. Those used at the insectary during March for the propagation of these parasites were third stage examples of *L. albohirta*.

The method adopted consisted in confining digger parasites separately in metal cages holding about 15 cubic inches of soil, the grubs with attached eggs being removed morning and evening and placed in shallow wooden trays containing cells formed of moist compacted soil. A convenient size of tray was found to be 16 inches by 13 inches, which allowed room for 60 cells, and when full, the trays were stacked so that the bottom of one formed the roof of the one below, leaving just enough room for the larvae to spin their cocoons.

From data obtained in the field it has been proved that third-stage larvae of *L. frenchi*, *L. albohirta*, and a few of *L. rothei*, derived from eggs deposited in December 1916, have during the past sixteen months been feeding in virgin soil on blady-grass and other cereals.

Urich (F. W.). **Thrips, Black Ants and other Insect Pests of Cacao in Grenada, with a Note on Coconut Disease.**—*Rept. presented to the Govt. of Grenada, Trinidad*, 1918, 23 pp., 6 figs.

Heliothrips (*Selenothrips*) *rubrocinctus* occurs on every cacao estate in Grenada, but is particularly abundant in the south and west. In the author's opinion this is due to lack of shade on the western part of the Island, and he considers that growers will have to choose between more shade or more spraying to control the thrips. Cacao is most severely injured in respect of the foliage, which frequently drops off, but the pods are also affected, becoming discoloured so that it is impossible to distinguish the ripe from the unripe ones. Eggs are laid by the female in the tissues of young leaves, the incubation period lasting 3 or 4 days. In cacao, oviposition occurs in pods that are nearly mature. The larvae require about 9 days to develop, then enter a pre-pupal state lasting 24 hours, followed by a pupal period lasting 48 hours. The females, which may live for several weeks, are parthenogenetic for several generations, a few males occurring generally at the end of the year. As the generations are continuous, the increase of thrips is rapid; other food-plants that are restricted to certain seasons for putting out new leaves and thus form continuous breeding-grounds are galba, hog plum, mango, guava, avocado, almond, mammee apple, cashew and roses. New shoots on cacao appear at the beginning of the rainy season and it is then that thrips begin to multiply on the cacao trees, the maximum appearance being just after the heavy rains of May and June. A certain degree of moisture seems to be necessary for the development of thrips; at the height of the dry season they are at their lowest ebb, although the damage done by them may be most apparent at that time. A table illustrates the seasonal history. Thrips are naturally controlled to a certain extent by heavy showers of rain and by excessive drought. In Grenada the larva of a lace-wing fly and in Trinidad several species of Reduviid bugs exercise some measure of control, but these do not confine

themselves to thrips and generally appear after the worst damage has been done. It is suggested that the introduction of some of these from Trinidad should be tried. A predaceous thrips has been observed in Grenada, but is not sufficiently numerous to be important. The practice of encouraging black ants for the control of thrips is a great mistake, as the numerous scale-insects and mealy-bugs that they foster on cacao are very injurious.

Artificial control of thrips, which is a necessity for cacao growers, should consist of spraying three times, at one month's interval, with Bordeaux mixture 5 : 5 : 50, to which is added nicotine sulphate 1 : 1000. The most important spraying is the first, which should be made just after the heavy rains. Kerosene emulsion is not recommended and should be used only in an emergency. The most suitable spraying machinery is described, and a table shows the increased yield of cacao from sprayed as contrasted with unsprayed trees.

Cremastogaster brevispinosa var. *minutior* (black, or acrobat ant) should be controlled by cutting away and burning all dead twigs and branches containing nests, and cutting out of the trunks of trees all nests and dead wood and loose bark. Crude petroleum should be applied to any cleaned-out part of a tree. Another method that has given success with the Argentine ant [*Iridomyrmex humilis*] in Louisiana consists in feeding the ants with weak solutions of arsenic which are strong enough to kill the larvae; it is suggested that experiments should be tried on these lines. Cacao trees are also injured by certain beetles; the usefulness of lizards in controlling these pests and the need for their protection is emphasised.

Coconuts in the Island are frequently injured by scale-insects, particularly *Aspidiotus destructor*, but these are generally kept within bounds by their natural enemies, provided that ants are kept from the trees. If necessary, a spray of 1 part commercial lime-sulphur to 15 parts water should be applied. The soil where coconuts are grown should be carefully drained, tilled and manured.

The last section of this report, which is intended for the guidance of the small proprietor and is issued as a separate paper, gives in a popular form the information contained in the first part and includes directions for spraying and instructions in preparing Bordeaux and other popular mixtures.

Smits van Burgst (C. A. L.). **De oeconomische Beteekenis der Sluipwespen.** [The Economic Importance of Ichneumonids.]—*Tijdschr. Plantenziekten, Wageningen.* xxiv, no. 3, May 1918, pp. 116-122. [Received 3rd September 1918.]

The Phytopathological Service at Wageningen is investigating Ichneumonid parasites of *Rhyacionia* (*Evetria*) *buoliana* (European pine-shoot moth), which causes severe injury to young pines in Holland, and in the present article some notes are given concerning the value of these parasites. In nature an Ichneumonid sometimes fails to attack an insect under conditions where parasitism seems probable, and furthermore, in a given region the various species parasitising a given insect occur irregularly. In one year one species is the predominant parasite and in another a different species plays this rôle. In the

author's opinion there can scarcely be any doubt that individual insects may also be immune from attack. These circumstances explain why Ichneumonids often prove unsatisfactory as a check. When reared in captivity, their increase is usually far from rapid, and the individuals thus obtained are inactive when released among host-insects. In spite of these limitations Ichneumonids still play an important part against insect pests; for instance, an outbreak of *Rhyacionia* (*Evetria*) *resinella*, L., in north Brabant was checked in this manner some years ago, 98 per cent. of the galls collected during the last year of the outbreak being parasitised, probably by *Glypta resinana*, Htg., and *Macrocentrus abdominalis*, F.

SPRENGER (A. M.). **De Bestrijding van Insecten met Arsenicum-praeparaten en het Gevaar voor de Bijenteelt.** [The Use of Arsenicals against Insect Pests and the Danger to Bee Farming.] —*Tijdschr. Plantenziekten, Wageningen*, xxiv, no. 3, May 1918; Bijblad, pp. 21–25. [Received 3rd September 1918.]

The spraying of fruit trees in blossom appears to be highly successful against insect pests, but the arsenical preparations used are dangerous to bees and many swarms have been destroyed owing to the drippings from the trees contaminating the Leguminosae growing beneath them. In 1916 bees in the currant plantations of Zeeland were killed by the Urania green solution employed against *Pteronus ribesii* (*Nematus ventricosus*) (currant and gooseberry sawfly). It is therefore important to find an efficacious insecticide which will be harmless to bees. Barium chloride has been placed on the market under the name of "Ventricosus-powder" and a 2 per cent. solution is said to destroy the pests without affecting bees. This remedy is not, however, a new one, nor does it appear to be harmless, as bees fed with honey containing 2 per cent. of barium chloride seemed to be affected thereby.

RITZEMA BOS (J.). **Aardvlooien.** [Flea Beetles.]—*Tijdschr. Plantenziekten, Wageningen*, xxiv, no. 3, May 1918; Bijblad, pp. 36–40. [Received 3rd September 1918.]

This is a popular article and states that a good method of combating these pests is to strew infested fields with sand with one-fifth of its volume of petroleum added and well mixed in. This repels the insects for about five days, by which time the young plants should be able to resist attack. If this is not the case, the treatment must be repeated.

SCHENK (P. J.). **In en op den Bodem levende Plantenvijanden, I.** [Plant Enemies living in or on the Ground. I.]—*Tijdschr. Plantenziekten, Wageningen*, xxiv, no. 4, July 1918, pp. 149–159, 2 figs. [Received 3rd September 1918.]

This paper deals with the following Melolonthids occurring in Holland:—*Melolontha melolontha*, *M. hippocastani*, *Amphimallus* (*Rhizotrogus*) *solstitialis*, *Polyphylla fullo*, and *Phyllopertha horticola*. *M. melolontha* is found chiefly in the eastern provinces, while *M. hippocastani* is more limited to the western ones. The former species is mainly responsible for outbreaks recorded; it is said to

complete its life-cycle in three years, and *M. hippocastani* in four. In certain districts, as for instance along the Rhine near Arnhem-Wageningen, so-called May-beetle seasons occur every three years. Ritzema Bos is of opinion that the large numbers of beetles constituting an outbreak have a numerous progeny, which however only appear three years later. Though there are still many beetles to be seen in the year following an outbreak, their newly hatched larvae are handicapped by the presence, in enormous numbers, of strong, one-year-old larvae descended from the adults of the outbreak year, and most of them finally succumb to the resultant unfavourable conditions. Oudemans also refers to the cannibalism of the larvae, by which the younger individuals fall victims to older and stronger ones. This would naturally tend to conserve a difference in numbers that has once been established. *Amphimallus solstitialis* occurs in the eastern provinces, the adult feeding on the leaves of various deciduous trees and on pine needles of the preceding year. The larva attacks grass roots and also injures rye. *Polyphylla fullo* is usually found in sandy neighbourhoods, especially on the North Sea dunes. It feeds on the young pine needles, as well as on those that are one year old, and also attacks deciduous trees. Its larva feeds on grass roots and severely injures the beach grass largely grown to protect the dunes. The roots of pine, *Robinia pseudacacia* and birch also suffer, and young trees may be killed. Collection appears to be the only method of checking this beetle. *Phyllopertha horticola* occurs in the drier districts and appears above ground towards the end of May and early in July. It feeds on the foliage of oak, beech and other deciduous trees, on young apple and pear fruits, and the stamens, pistils and buds of the rose. The larva feeds on the roots of grasses, the life-cycle occupying one year. Remedial measures include jarring the plants, which must be done early in the morning, and spraying with a poison such as lead arsenate or Paris green, mixed at the rate of 1 per cent. in a 1 per cent. solution of milk of lime.

STIELTJES (D.). **De Bestrijding van Aardvlooien.** [Measures for combating Flea-Beetles.]—*Tijdschr. Plantenziekten, Wageningen*, xxiv, no. 4, July 1918; Bijblad, pp. 43–44. [Received 3rd September 1918.]

About 1910 the author began some experiments with trap-plants for flea-beetles and this method has continued to prove successful. *Lepidium sativum* was chosen for the purpose and was planted between rows of cabbages of different kinds. Other growers who tried this plan also reported very favourably upon it. *L. sativum* grows rapidly, so that the beetles are quickly attracted; it need not be feared as a weed, and its seed is cheap.

MAARSCHALK (H.). **Musschen en Appelbloesemkevers.** [Sparrows and *Anthonomus pomorum*.]—*Tijdschr. Plantenziekten, Wageningen*, xxiv, no. 4, July 1918; Bijblad pp. 45–46. [Received 3rd September 1918.]

This note points out that sparrows are not without their uses in orchards, for they have been seen to search for and destroy the larvae of *Anthonomus pomorum* infesting apple trees.

PAOLI (G.). **Campagna antiacridica in Capitanata nel 1917.** [The Campaign against Locusts in Capitanata in 1917.]—*Boll. Ministeri Agricoltura, Industria, Commercio, Lavoro, Rome*, Parte non ufficiale, Year xvi, vol. ii, Ser. B, no. 5–6, November–December 1917, 5 pp., 1 map. [Received 2nd September 1918.]

The campaign against *Dociostaurus maroccanus* in Capitanata (province of Foggia) was begun in 1916. As no definite information could be obtained as to the areas where the eggs had been deposited, about 5 tons of Cresosol and a number of sprayers were obtained for the campaign against the adults in 1917. The appearance of these was reported on 5th May and spraying with a 5 per cent. solution of Cresosol was at once begun, the strength of the solution being increased to 6, 7 and 7½ per cent. as the locusts grew older. The stock of Cresosol was exhausted on 19th May and sodium arsenite had to be substituted, in solutions of 1, 2 and 3 per cent. strength. Spraying was effected with Cresosol to kill masses of locusts and with sodium arsenite to establish protective zones. Where water was not obtainable in the neighbourhood, bran with the addition of 3 per cent. sodium arsenite was used and proved very satisfactory. Bags of poisoned bran were sent to small growers who required assistance. Cloth barriers handled by gangs of women were also used for dealing with the young adults, but were given up later on. The first deposition of eggs was observed on 22nd June and an accurate survey was made over an area of about 36 square miles. In one locality *D. maroccanus* was not found, but *Calliptamus*, *Oedipoda* and *Stenobothrus* were represented.

Cresosol has the disadvantage of injuring the rubber and leather parts of the sprayers, while the prolonged handling of sodium arsenite causes inflammation and burns. Spraying furthermore requires a considerable quantity of water, which is not always available. Poisoned bran gave excellent results and eliminated this difficulty.

As a preventive measure for the 1918 campaign, the early destruction of the eggs is advised. Cresosol is not recommended for the reasons given, but the sodium arsenite spray and especially poisoned bran should be employed.

PORTER (C. E.). **Notas breves de Entomología agrícola.** [Brief Notes regarding Agricultural Entomology.]—*Anales Zool. Aplicada, Santiago de Chile*, iv, no. 3, 30th September 1917, pp. 44–46. [Received 5th September 1918.]

This is the second note of a series on this subject [see this *Review*, Ser. A, vi, p. 429]. From one locality orange leaves were received infested with the scale-insects, *Lepidosaphes beckii*, Newm., *Chrysomphalus aonidum*, L., and *Hemichionaspis aspidistrae*, Sign. This last is new to Chile and must be a recent introduction. The termite, *Calotermes chilensis*, was abundant in various parts of the country in 1916.

DA MATTA (A. A.). **Larvas de Lepidoptero perjudiciaes ao Genero *Citrus*.** [A Lepidopterous Larva injurious to the Genus *Citrus*.]—*Anales Zool. Aplicada, Santiago de Chile,* iv, no. 3, 30th September 1917, pp. 47–51, 1 fig. [Received 5th September 1918.]

This paper deals with the butterfly, *Papilio idaeus*, F., infesting citrus plants in Brazil. The caterpillars are gregarious and are easily found on Aurantiaceae, especially orange and lemon trees. The eggs are attached to the leaves in groups and the caterpillars hatch out in 8–10 days. In the final stage, about 20–25 days later, they abandon their gregarious habit. The pupal stage lasts 18–22 days. Spraying with a petroleum soap emulsion is advised when the caterpillars are young. At a later date they must be collected. All leaves bearing eggs must be picked and destroyed.

LIZER (C.). **El Polisulfuro de Calcio.** [Calcium Polysulphide.]—*Anales Zool. Aplicada, Santiago de Chile,* iv, no. 3, 30th September 1917, pp. 51–52. [Received 5th September 1918.]

The following data are given regarding the preparation of calcium polysulphide spray solution :- To obtain the maximum of polysulphide the mixture must not be boiled for more than 60 minutes; 50 to 60 minutes is the correct time. The maximum of CaS_2O_3 occurs in 30–45 minutes. Density is no guide to the percentage of polysulphide. The olive green colour of the residue from the lime-sulphur mixture is entirely due to the iron content in the lime. The solution must be used fresh or stored in air-tight containers. Of the three formulae analysed, that of Savastano [see this *Review*, Ser. A, ii, p. 412] contains most polysulphide, as the proportions of lime and sulphur are most correct. The needle-like crystals that occur in concentrated solutions cannot have the composition alleged by Van Slyke, Hedges and Bosworth. They are almost certainly an oxygen compound with the addition of water of crystallisation.

MAKI (M.). **Taiwansan Kebuka-aburamushi oyobi sono Isshinshu ni tsukite.** [The Genus *Trichosiphum* in Formosa with Descriptions of New Species.]—*Taiwan Nojiho* [*Formosan Agricultural Report*], *Formosa*, no. 138, 31st May 1918, pp 9–17, 1 plate.

The author describes four species of Formosan Aphids belonging to the genus *Trichosiphum*, of which one is new to science, viz.:—*Trichosiphum nigrum*, Maki, on *Quercus formosana*; *T. formosanum*, Maki, on *Psidium guayava*, *Rhodomyrtus tomentosa*, *Ficus retusa* and *F. wightiana*; *T. nigrofasciatum*, Maki, on *Quercus serrata*, *Q. variabilis*, and *Q. formosana*; and *T. lithocarpae*, sp. n., on *Lithocarpus uraiana*. A few remarks on the bionomics of these species are added.

ABE (Y.). **Kinkemushi no Sanji oyobosu Gaidoku.** [Injury to Silkworms by Caterpillars of the Gold Tail Moth.]—*Sangyo Shimpo* [*Journal of the Silk Industry*], *Tokyō*, no. 304, 1st July 1918, pp. 890–894.

In the spring of 1918 the author found that silkworms of the fifth instar suddenly lost their appetite, and became inactive and vomited

a green fluid as if they had been poisoned by insect powder or tobacco. Some individuals also developed dark patches on the body. As these symptoms differed from those of any known disease of silkworms, the author investigated the matter and succeeded in finding the cause. His attention was first drawn to the fact that those who were handling mulberry leaves were suffering from severe irritation caused by caterpillars of the gold-tail moth, *Arctornis chrysorrhoea*, L. (*Porthesia similis*, Fuess.). Experiments were made on batches of silkworms fed on mulberry leaves that had previously been in contact with these caterpillars, while others were fed on clean leaves as a control, and it was clearly demonstrated that the symptoms observed were due to the presence of these caterpillars. The urticating hairs of the caterpillar may be eaten by the silkworm or they may become attached to its body by contact. In the former case vomiting is caused, while in the latter dark patches appear on the body. There can be little doubt that the so-called "black-patch" disease of silkworms, the cause of which has hitherto been unknown, is due to the urticating hairs of *Arctornis chrysorrhoea*.

NISHIKAWA (I.). **Sanji Hantenbyo no Genin to odorokubeki Kinkemushi (*Porthesia similis*, Fuess.) no Dokumo Sayo.** [The Cause of "Patch" Disease of Silkworms and the terrible Urticating Hairs of the Gold-Tail Moth Caterpillar, *Porthesia similis*, Fuess.]—*Sangyo Shimpo* [*Journal of the Silk Industry*], *Tokyo*, no. 305, 1st August 1918, pp. 998–1003.

The author has come to the conclusion, independently of the experiment in the previous paper, that the so-called "patch" disease of silkworms is due to the urticating hairs of the caterpillar of the gold-tail moth, *Arctornis chrysorrhoea* (*Porthesia similis*). Dark patches are said to occur both in young and mature silkworms, though in the author's experiments only individuals from the fifth instar onwards were used. Dark patches may be similarly caused on *Theophila mandarina*, Moore, and *Zamacra albofasciaria*, Leech. The intensity of the affection varies among different races of silkworms, the endemic race being rather susceptible.

NISHIGAKI (T.). **Kurimushi no Riyo. [Utilisation of the Chestnut Caterpillar.]**—*Sangyo Shimpo* [*Journal of the Silk Industry*], *Tokyo*, no. 305, 1st August 1918, pp. 1007–1009.

The author states that Uchida of the Tochigi Prefecture has invented a method of preparing a kind of thread from the old cocoons of the Saturniid Moth, *Dictyoploca japonica*, Butler. He has obtained a special permit from the Imperial Government and contemplates making a textile fabric from it. The moth is well-known as an injurious insect that feeds on many forest and orchard trees, such as chestnut, camphor, pear, apple, etc. The cocoons are collected by means of a long stick with an iron hook on the top. As is usual in the case of insects under natural conditions, the harvest of cocoons may fluctuate greatly from year to year so that the possibility of continuous manufacture may be expected to be uncertain. The thread made is also used as hair for dolls.

ISHIKAWA (T.). **Ine Nika-Meichu Kujohô to shite Wara-niho Kakiharai ni Kansuru Chôsa Kenkyu.** [Researches on the Method of Raking Straw-Stacks, as a Control Measure for the Two-brooded Rice Borer.]—*Tokubetsu Hokoku* [*Special Report*], *Agric. Expt. Sta., Niigata*, 25th July 1918, pp. 48, 2 plates.

The system of raking the straw-stacks is considered one of the most effective measures for dealing with the serious rice pest, the two-brooded rice-borer (*Chilo simplex*. Butl.). and this report gives a detailed account of its value. It has long been practised amongst farmers of the Kita-Kambara District of the Niigata Prefecture, and in 1904 it was recognised as very effective by the Prefectural Agricultural Experiment Station and is now generally encouraged. To carry it out the rice straw should be stacked as follows: First the ground should be covered with rice hulls or straw to a depth of five or six inches in circular patches 8 or 9 feet in diameter for protection against wet. Upon this foundation, sheaves are laid round the circumference of the circle with their stubble ends directed outwards, the centre being also filled up with other sheaves. This is done to the height of about 5 feet, the whole being held together with ropes and thatched with straw.

For raking the heap, a special implement is necessary, two kinds of which are described and compared. Before raking the stack, the ground surrounding it should be covered with mats to catch any larvae that drop from it. The work is done by two men, one on each side, who rake the sides of the stack as vigorously as possible, gradually travelling round it and making two complete circuits of it. This method, however, may be almost useless unless it is carried out at the proper season, *i.e.*, when the mature larvae are migrating towards the surface of the stack to pupate, so that the accurate determination of this point is most important. In Niigata, except in special circumstances, the period in question is from the middle of May to the middle of June, and it has been found from experiments that after 11 a.m. and after 3 p.m. are the best times of the day. The satisfactory results obtained with this method are shown in numerous detailed tables.

MAKI (M.). **Boko-cho ni okeru "Kattsau Kua" ni tsukite.** [On the "Kattsau Kua" of the Pescadores.]—*Konchu Sekai* [*Insect World*], *Gifu*, vol. xx, no. 250, 15th June 1918, pp. 1–8, 1 plate.

The Capsid bug, *Halticus minutus*, Reut., which is a noted sweet-potato pest in India, has recently begun to ravage the Pescadores Islands. It chiefly attacks the leaves and stalks of the peanut, sweet-potato, water-melon, cucumber, pumpkin, cabbage, peppermint, *Luffa cylindrica*, *Rhaphanus sativus*, *Cucumis melo*, *Brassica campestris*, *Vigna sinensis*, *Phaseolus vulgaris*, *Solanum melongena*, *Chrysanthemum sinense*, *Erythrina indica*, *Ficus retusa*, *Pachyrhizus angulatus*, etc. It appears to have several generations per annum and the adults are present throughout the year. Outbreaks of this pest occur intermittently, the last serious one having been in 1916. Its appearance in large numbers has hitherto been considered to be due to the occurrence of exceptionally wet seasons favourable to its multiplication,

but the author has some evidence that drought has the same result, as the insect is well able to withstand it, while its natural enemies are killed. There is no satisfactory remedial measure known, though kerosene emulsion with insect powder or tobacco extract may be of some use.

NISHIGAYA (J.). **Honnen Aomoriken no Heikwa ni Daihassei seru Kashiwa-kemushi ni tsuite.** [On the Caterpillars of *Lymantria mathura* that appeared in Abundance on the Apple in 1918.]—*Konchu-Sekai* [*Insect World*], *Gifu*, vol. xxii, September 15th, 1918, pp. 13–20.

Lymantria mathura, Moore, which is known to feed on forest trees, especially on *Quercus dentata*, appeared in immense numbers in apple orchards of the Minamitsugaru District of the Aomori Prefecture, in July 1918. The caterpillars defoliated many of the orchards of this apple-growing district to such an extent that in some places the trees were cut down for charcoal and the harvest lost. The caterpillar hatches from the end of May to the beginning of June, matures from the middle to the end of July and pupates from the end of July to the beginning of August. The adult emerges in August and oviposits shortly afterwards. The larvae on hatching remain in a mass for 4 or 5 days and then begin to disperse. Whereas the gipsy-moth caterpillar [*Lymantria dispar*] does not exhibit a preference for apple foliage, the present species feeds chiefly at first on the young buds and later attacks the larger leaves of apple. The former caterpillar usually rests in cracks of the bark or at the base of a branch, while the latter shelters itself within the foliage. The adult female of *L. mathura* is more active than that of *L. dispar*, while the male is less so. The eggs are laid usually on pine trees, if there are forests of this tree near the apple orchard, and such trees should be examined for egg-masses.

As regards remedial measures, since the caterpillars are still very small in the middle of June, spraying with any insecticide and applying adhesive bands to prevent them climbing the trunks are very effective. For the spray, kerosene emulsion (1 in 20) is good by itself, or mixed with insect powder (1 in 30), or with tobacco (1 in 20), or with fish-oil (1 in 20), the last being the best of all. For adhesive bands tar or bird-lime is used. The collection of mature caterpillars and of pupae among the foliage is also of some value.

SILVESTRI (F.). **Contribuzione alla Conoscenza del Genere** *Centrobia*, **Förster.** [A Contribution to the Knowledge of the Genus *Centrobia*, Förster.] *Boll. Lab. Zool. Gen. Agrar. R. Scuola Sup. Agric., Portici*, xii, August 1918, pp. 245–251, 4 figs.

This paper re-describes the Chalcidid genus *Centrobia*, Förster. *C. walkeri*, Först., was taken in Italy from twigs of *Quercus robur*, from which were also obtained specimens of *C. walkeri*, Förster, var. *minor*, nov. This variety also occurs on *Quercus ilex*. *C. similis*, sp. n., is described from specimens taken in Italy from the hazel (*Corylus avellana*).

VAN HALL (C. J. J.). **De Bescherming der Cultuurgewassen tegen nieuwe Ziekten en Plagen uit het Buitenland.** [The Protection of Cultivated Plants against new Diseases and Pests from Abroad.] —*Tijdschr. Teysmannia, Batavia*, ii, 1918, pp 62–95. [Received 11th September 1918.]

The title indicates the scope of this paper, which is a résumé of present day knowledge on the subject. In the Dutch East Indies the importation of sugar-cane, tea seed and fresh fruit from Australia, and coffee seed from America, is under legislative safeguards, but a more general control of imported seeds and plants is required.

WATSON (J. R.). **Thysanoptera of Florida.**—*Florida Buggist, Gainesville*, i, no. 4, & ii, no. 1, 21st March and 22nd June 1918, pp. 53–77. [Received 24th September 1918.]

All thrips are of potential economic importance, most of the species being plant feeders, while some are predatory on other small insects and mites, one Florida species feeding on the eggs and larvae of white-fly [*Aleurodes* sp.]. In Florida they do not hibernate, though they remain quiescent during the cold weather; further north they hibernate in either the adult, egg, or larval stage.

A preliminary list of 52 species recorded as occurring in Florida is given, with notes on their distribution, food-plants, season and habits. These include: *Aeolothrips floridensis*, Wats., a comparatively rare species, taken on oats and maize, always associated with *A. bicolor*, Hinds (black and white cereal thrips) often abundant on oats in spring, causing material damage, and also recorded from *Plantago virginica*, onions, rutabaga, strawberries and citrus; *Franklinothrips vespiformis*, Crawf., on citrus leaves; *Thrips tabaci*, Lind. (onion thrips), cosmopolitan in its distribution, being the most serious pest of onions in the State, doing great damage annually and also recorded on cabbage, cauliflower, and crabgrass (*Panicum sanguinale*); *Heliothrips haemorrhoidalis*, Bch. (greenhouse thrips), common in Florida in gardens and on ornamental plants, but in the northern States confined to greenhouses, also recorded on mango, avocado and the foliage of *Acer rubrum*; *H. rubrocinctus*, Giard (red-banded thrips) on avocado and mangos, a severe pest of the latter, causing the leaves to lose colour and fall, introduced from the West Indies; *Limothrips cerealium*, Hal. (cereal thrips), on oats, widely distributed and occurring also in Europe; *Chirothrips manicatus*, Hal., also widely distributed on oats; *Scolothrips sexmaculatus*, Perg., found feeding on red-spider and also in the Hawaiian Islands; *Frankliniella fusca*, Hinds (tobacco thrips), on tobacco, peanuts, sorrel, dewberry, mustard, shepherd's purse, turnips and strawberries; *F. floridana*, sp. n., on velvet beans (*Stizilobium*); *F. occidentalis*, Perg., on beans and mango; *F. bispinosus projectus*, Wats. (Florida flower thrips), the commonest local species, taken all the year round on a great variety of plants, all the records in local literature probably referring to this variety or to *F. bispinosus*, Morg.; *Cryptothrips floridensis*, Wats. (camphor thrips), probably an introduced species; *C. citri*, sp. n., found under the loose bark of a citrus tree affected with gummosis; and *Leptothrips mali*, Fitch (black garden thrips), on citrus foliage at all seasons, also on magnolia, beans, coffee-bean, cotton, radishes, mustard, turnips and grasses.

Useful keys to the North American species of *Heterothrips*, *Anthothrips*, *Cryptothrips* and *Phloeothrips* are also given, with a bibliography of 36 works.

WALLACE (F. N.). **Ninth Ann. Rept. (1915–1916) Indiana State Entomologist,** ***Fort Wayne,*** **1917, 230 pp.** Illustrations & 60 figs. [Received 26th September 1918.]

This report gives an account of the insect pests of the year under review and is compiled for the guidance of growers, the information being of a popular nature and very few scientific names being included. The inspection of nursery and imported stock has been carefully carried out. The European elm scale [*Gossyparia spuria*, Mod.], which has only once before been found in Indiana, and then only upon a few trees in a nursery, appeared in one locality. Scalecide 1 part to 15 of water proved effective and will be used largely in the spring in an effort to exterminate this scale before it becomes established and spreads. Individuals of *Lagoa crispata*, Pack. (yellow flannel moth), which has not previously been recorded in Indiana, were found feeding on sassafras in June 1916. The larvae are covered with hairs that produce intense irritation in the skin of the person handling them. It is hoped that all larvae were collected, but watch will be kept for them in the coming season. An account is given of the spraying of fruit-trees as practised in Indiana.

KINSEY (M. E.). **Onion Thrips (*Thrips tabaci*)**—*Ninth Ann. Rept. (1915–1916) Indiana State Entomologist, Fort Wayne,* 1917, pp. 43–47, 5 figs. [Received 26th September 1918.]

Thrips tabaci has seriously injured onions in Indiana for the past few years, especially in districts where they have been grown commercially for some time. Females appear in the spring or early summer, having presumably spent the winter in the rubbish and old tops on the ground. Eggs are deposited just under the epidermis of the leaves and hatch in a few days, the nymphs immediately beginning to suck the plant juices. After passing through several moults the adult stage is reached, the whole life-cycle lasting only three weeks, so that several generations may be produced in a year. A contact spray should be applied at intervals of not more than 3 weeks until the pest is controlled. The formula recommended is 4·3 oz. of nicotine sulphate and 4 lb. whale-oil soap to 50 U.S. gals. water. A spraying machine designed by the author for the control of this thrips is described with diagrams.

SNODGRASS (R. E.). **Some of the Important Insect Pests of Indiana.** —*Ninth Ann. Rept. (1915–1916) Indiana State Entomologist, Fort Wayne,* 1917 pp. 105–230, 60 figs. [Received 26th September 1918.]

This paper describes many of the common insect pests found in Indiana with the usual recommendations for their control. The author has observed the parasitism of the tussock moth [*Hemerocampa leucostigma*] by a parasite that he believes to be *Dibrachys boucheanus*, though other authors have recorded this Chalcid as a hyper-parasite only. Besides agricultural pests, a number of household and granary pests are also dealt with.

BAIRD (A. B.). **Some Notes on the Natural Control of the Cherry-tree Ugly Nest Tortricid, *Archips cerasivorana*, Fitch.**—*Agric. Gaz. Canada, Ottawa*, v, no. 8, August 1918, pp. 766–771, 6 figs.

The large tent-like webs of *Tortrix* (*Archips*) *cerasivorana*, Fitch, are frequently seen during June and July on choke-cherry trees along country roads in Canada. The eggs of this moth are deposited in late July or early August on the bark of small cherry trees, generally near the base, very little development taking place in the embryo until the following spring. In the egg-stage this moth is parasitised by the Chalcid, *Trichogrammatomyia tortricis*, Gir., which probably spends 4 or 5 weeks in the host egg, as the adults emerge during the end of August and beginning of September. In 1917 from 75 per cent. to 80 per cent. of the eggs were killed by this parasite. The larvae of *T. cerasivorana* hatch during late May and early June and crawl to the top of one of the branches, where they congregate in the opening leaves, spin their webs and begin to feed, extending the web to cover fresh food as this is required. As soon as there is sufficient excreta and frass in the nest, the larvae construct among it silk-lined cells in which they live individually. There are six larval instars, most of the larvae being mature by mid-July. Several species of parasites have been reared from the larvae, those occurring in Canada including *Apanteles* sp., several individuals of which issued from young larvae. The Tachinid, *Dichaetoneura leucoptera*, Johns., infests the larvae of *T. cerasivorana* during the first three weeks of July. The parasitic larvae moult twice and become full-grown in about 3 weeks, when they eat their way through the side of their host and either pupate in the nest or fall to the ground and pupate under rubbish. The host larvae may live for some time after the parasites have escaped, but none reach maturity. The adult parasites emerge in 10 to 14 days and live for some considerable time, possibly wintering in this condition. As many as 40 per cent. of the larvae have been parasitised by this species. The Hymenopteron, *Erigorgus prismaticus*, Nort., usually destroys 25 to 30 per cent. of the larvae. Eggs are deposited in the host larvae when about two-thirds grown, and the parasitic larvae grow very slowly until after the host has pupated, when they rapidly devour the tissues and mature in a few days, pupating in the empty pupal skin of the host and emerging in a week or 10 days. They probably winter in the adult stage. The Tachinid, *Exorista boarmiae*, Coq., attacks both the larval and pupal stages, pupating in the empty pupal cases of the Tortricid and issuing as adults in about two weeks. Parasitism by this species was not found in more than 5 per cent. of the individuals examined. Predaceous birds and insects have very little chance of controlling *T. cerasivorana* in the larval stage owing to the nature of the nest. Pupation takes place within the cells in the nest, and after about ten days, when the adults are about to emerge, the pupae come out of their cells and attach themselves to the outside of the web. *Scambus conquisitor*, Say, is the only true pupal parasite, but is responsible for the destruction of less than 5 per cent. of the pupae. Many pupae however die, apparently owing to drying up of the pupal case. The adults do not disperse to any distance unless carried by wind. Adverse weather conditions and the work of birds throughout the season, together with parasitism by insects, are generally sufficient to hold this Tortricid in check.

Report on the Occurrence of Insect and Fungus Pests on Plants in England and Wales in the Year 1917.—*Bd. Agric. Fisheries, London*, Miscell. Publications, no. 21, 1918, 32 pp.

The chief insect pests on crops in England and Wales during 1917 were:—Diptera. *Mayetiola destructor*, Say (Hessian fly), on wheat, especially the "Sensation" variety; *Hylemyia coarctata*, Fall., causing extensive injury to winter wheat, wheat following potatoes being most frequently attacked; *Hylemyia antiqua*, Meig. (onion-fly), a serious pest in almost every district, plants from early sown seeds being less liable to attack; *Chlorops taeniopus*, Meig. (gout fly), responsible for much damage to barley in the eastern and midland counties; *Oscinella* (*Oscinis*) *frit*, L. (frit fly), causing severe and wide-spread damage to wheat and oats, especially when the latter is grown after grass; *Agromyza graminis*, Kalt., the larvae being reported as mining wheat-leaves; *Pegomyia betae*, Curt., a serious and wide-spread pest of mangels, also attacking sugar-beet in Lancashire; *Contarinia onobrychidis*, Kieff., attacking sainfoin in the eastern counties; *Phorbia* (*Chortophila*) *brassicae*, Bch. (cabbage-root fly), causing considerable and wide-spread damage, in one case tarred discs failing to give protection, while in another a mixture of naphthaline and lime scattered round the plants prevented attack; *Psila rosae*, F. (carrot-fly), abundant in Cheshire, even on plots treated with tar-oil, also attacking parsnips; *Acidia heraclei*, L. (celery-fly), recorded from most districts, damaging parsnip and celery; and *Contarinia* (*Diplosis*) *pyrivora*, Ril., causing much loss in pears in many districts.

Rhynchota. *Calocoris norvegicus*, Gmel. (*bipunctatus*, L.), *Lygus pratensis* var. *campestris*, Fall., and *L. pabulinus*, L., causing wide-spread damage to potatoes; the Capsid, *Plesiocoris rugicollis*, Fall., causing damage to apples by malformation and distortion; *Aleurodes brassicae*, Wlk., abundant on cabbages in the west of England; *A. vaporariorum*, Westw., seriously injurious to tomatoes in the Isle of Wight, where it was controlled without injury to the plants by fumigation with hydrocyanic acid gas, ⅛ oz. sodium cyanide being sufficient for each 1,000 cubic feet of space; and *Pseudococcus aceris*, Sign., recorded from apples in Kent and Sussex.

The Aphids recorded include:—*Trama troglodytes*, Heyd., on the roots of artichokes in Kent; *Macrosiphum granarium*, Kirb., very abundant and causing considerable damage to wheat and oats in the eastern counties; *Macrosiphum solani*, Kalt., *Rhopalosiphum solanella*, Theo., and *Myzus solanina*, Pass., reported as harmful and abundant on potatoes in several southern counties; *Aphis rumicis*, L., recorded from Shropshire and Yorkshire on root-crops and also on beans in the north of England; *Rhopalosiphum dianthi*, Schrk., causing considerable damage to turnips in Yorkshire, swedes being comparatively immune, even when grown in the same field; *Callipterus ononidis*, Koch (*C. trifolii*, Mon., *Chaitophorus maculatus*, Buckt.), known as the yellow clover aphis in America, and occurring also in India and Egypt, recorded from red clover in two localities; *Pemphigus lactucarius*, Pass., reported as causing considerable damage to lettuces in widely separated localities; *Aphis mali*, F., and *A. malifoliae*, Fitch, plentiful in Kent and Worcester during July; *A. pruni*, Koch, very injurious to plums in Wiltshire; *Hyalopterus*

pruni, F. (mealy plum aphis), very general in Cambridgeshire; *Eriosoma* (*Schizoneura*) *lanigerum*, Hausm., reported as doing much damage in the eastern counties.

Coleoptera. Wireworms, doing much damage to oats and barley on newly-broken grass-land; *Lema melanopa*, L., very abundant on wheat in Kent and Shropshire in July; *Psylliodes affinis*, Payk. (potato flea-beetle), a well-known Continental pest, reported as damaging potatoes in many districts, its normal food-plant in this country being *Solanum dulcamara* (woody nightshade), also recorded as attacking apple foliage in Kent; *Atomaria linearis*, Steph., injuring seedling mangels; *Phyllotreta nemorum*, L., on turnips, successfully controlled by spraying with a quassia and soap mixture; *Melolontha melolontha*, L., the larva being reported as attacking mangels; *Bruchus pisorum*, L. (*pisi*, L.), responsible for considerable damage to peas in Shropshire; *B. rufimanus*, Boh., severely attacking beans; *Sitones lineatus*, L., causing the worst attack within recent times on peas and beans, in many places completely destroying the crop, the best control having been obtained by an early application of soot, or, failing this, fine road dust, a later spraying with lead arsenate also proving beneficial; *Apion trifolii*, F., in one district damaging the foliage of dwarf and runner beans, to which it had migrated from a neighbouring stack of lucerne and clover, also attacking parsnips, and in another locality the green fruit of peaches; *Phyllopertha horticola*, L., attacking the flower-heads and young shoots of peas and beans, and damaging sandy pastures in North Wales; *Amphimallus* (*Rhizotrogus*) *solstitialis*, L., the larvae attacking cabbages in Cambridgeshire; *Byturus tomentosus*, F., causing much damage to raspberries and loganberries in Shropshire and the eastern counties; *Galerucella tenella*, L., severely attacking strawberries at Buckingham; *Otiorrhynchus picipes*, F., causing very serious damage to raspberries; *Anthonomus rubi*, Hbst., causing much loss to strawberry growers; *Xyleborus dispar*, F. (shot-borer beetle), a few serious cases of damage to plum trees being recorded from the southern counties, *X. xylographus* (*saxeseni*, Ratz.), being also implicated; and *Scolytus rugulosus*, Ratz., causing severe damage to plums in Worcestershire.

Lepidoptera. *Hydroecia micacea*, Esp., widely distributed in allotments, etc., in June and July and doing extensive damage; *Pieris brassicae*, L., the larvae being reported as damaging the pods of turnips and swedes grown for seed, and together with *P. napi* being universally abundant and causing widespread damage, in one case attacking onions, a very high percentage of the larvae, however, being parasitised and in some places kept in check by hand-picking, dusting with fresh slaked lime and spraying with a solution of common salt; *Plutella maculipennis*, Curt. (diamond-back moth), which was not plentiful, one small attack being reported from Yorkshire; *Caradrina clavipalpis*, Scop. (*quadripunctata*, F.), the young larvae doing great damage to stacked peas in Essex; *Hepialus* sp., the larvae being found boring into the stems of broad beans; *Charaeas graminis*, L. (antler moth), a general outbreak occurring from the Peak to the Lake District on poor upland pastures; *Barathra* (*Mamestra*) *brassicae* L., causing considerable losses of cabbages etc. generally, and also reported as attacking onions and green tomatoes; *Cheimatobia brumata*, L. (winter moth), exceedingly abundant in practically

every fruit-growing district; *Arctornis chrysorrhoea*, L. (*Porthesia similis*) (gold-tail moth), common on apples in Cheshire; *Scotosia dubitata*, L., recorded as attacking apples; *Sphinx* (*Smerinthus*) *ocellatus*, L. (eyed hawk moth), the larvae doing considerable damage to apple trees; *Gastropacha* (*Lasiocampa*) *quercifolia*, L. (lappet moth), very prevalent on plum trees in Kent and Worcester; *Cydia* (*Opadia*) *funebrana*, Tr., causing much damage to plum fruit in Kent; *Cydia pomonella* (codling moth), causing much loss in apples in the south-east and eastern counties; and *Oxygrapha* (*Acalla*) *comariana*, Z. (strawberry tortrix), responsible for much damage to the strawberry crop in the Wisbech area.

Hymenoptera. *Emphytus* sp., found attacking apples in Kent; *Fenusa pumilis*, Htg., damaging logan-berries and laxton-berries in Kent; *Eriocampoides* (*Eriocampa*) *limacina*, L., abundant on pear in the eastern counties; *Pteronus* (*Nematus*) *ribesii*, Scop. (gooseberry sawfly), causing considerable damage by its general attacks; and *Hoplocampa testudinea*, Htg., recorded as spoiling much of the apple crop near Pershore.

Collinge (W. E.). **Some Recent Investigations on the Food of Certain Wild Birds.**—*Jl. Bd. Agric., London*, xxv, no. 6, September 1918, pp. 668–691, 17 figs.

The relationship between the feeding habits of wild birds and agriculture is as yet only very imperfectly realised, the value of many of the earlier contributions to the subject being seriously minimised owing to the methods employed in estimating the food-contents of the crop and stomach. Economically considered, birds are simply natural forces, the best economic conditions probably being fulfilled when they are numerous as species and moderately abundant as individuals.

As the result of an examination of the stomach (and crop, where present) contents of 3,670 adult birds and 595 nestlings, embracing 9 species of wild birds, it may be stated: (1) that the volumetric method (or percentage by bulk) is the only reliable one for estimating the nature of the food and the true economic position of a given bird; (2) that the numerical method is highly misleading and unsatisfactory; (3) that of the 9 species of wild birds treated, two are distinctly injurious, viz., the house sparrow and the wood pigeon: two are too numerous, and consequently injurious, viz., the rook and the sparrow hawk; one is locally too numerous, viz., the missel thrush; four are highly beneficial, viz., the sky-lark, the green woodpecker, the kestrel and the lapwing; (4) that in the interests of agriculture it is very desirable that strong repressive measures be taken against the house-sparrow and the wood-pigeon, and for the time being, all protection withheld from the rook, sparrow-hawk and missel thrush, while every protection should be given to the four highly beneficial species above mentioned; (5) that all the commoner species of wild birds require re-investigating so far as their food and feeding habits are concerned, and that their various food items require working out and estimating by the volumetric method.

MOSLEY (F. O.). **Fungoid and Insect Pests and their Control. Part I. Vegetable and Pulse Crops.** 26 pp. Price 1*s*. net. Illustrated. **Part II. Fruit Trees.** 31 pp. Price 2*s*. 6*d*. net. Illustrated. —Published by the Author, Whernside, Basingstoke Road, Reading.

The first of these useful pamphlets is intended to provide a means of easily recognising the more commonly occurring fungoid and insect pests of vegetable crops, and to indicate concisely in each case the most effective means of control and the stage in the life-history of the insect at which control measures are most efficacious. The importance of a suitable sprayer, promptitude in dealing with pests at the first moment of their appearance and preventive measures before the insects appear are indicated as essentials in success. A very brief and concise description is given of each insect, its life-history, the damage it does and the necessary measures for control. Illustrations in colour are given of the various stages of each insect.

The second pamphlet, dealing with fruit-tree pests and diseases is compiled on the same lines. The importance of avoiding overcrowding in orchards is insisted upon. General measures that should be practised in every orchard include a winter wash of caustic soda applied to the tree every three or four years and an application of limewash in the intervening years just before the buds expand. Trees should be grease-banded from October to April, and immediately the flowers have fallen sprays should be applied of combined lead arsenate and Bordeaux mixture or sulphur, according to the varieties to be sprayed. All new stock should be carefully examined before being planted. Each pamphlet concludes with instructions for the preparation of suitable sprays and washes.

MUESEBECK (C. F. W.). **Two Important Introduced Parasites of the Brown-tail Moth.**—*Jl. Agric. Research, Washington, D.C.*, xiv, no. 5, 29th July 1918, pp. 191–206, 4 plates.

A brief account is given of the life-history of *Nygmia phaeorrhoea*, Don. (*Euproctis chrysorrhoea*, L.), of which two important parasites, *Apanteles lacteicolor*, Vier., and *Meteorus versicolor*, Wesm., are dealt with in this paper. Both of these are widely distributed in Europe, and, upon their introduction into New England, spread so rapidly that after the distribution of 150 colonies of the former and 20 of the latter, no further colonisation has been necessary, both parasites having been found practically throughout the entire brown-tail moth area.

Apanteles lacteicolor oviposits in first and second stage larvae of *N. phaeorrhoea* in August, newly-hatched larvae being preferred. Usually only one egg is placed in each larva, a single female parasitising up to 300 larvae. The egg of *A. lacteicolor* hatches in about 3 days, the larvae at first feeding very slowly. It has been observed that when either of the parasites, *Zygobothria nidicola*, Towns., or *Meteorus versicolor*, were present with *A. lacteicolor* within the host larva, the two former invariably died before mid-winter, evidently as the result of some toxic action induced by the larvae of *A. lacteicolor*. In May, when the larvae of *N. phaeorrhoea* resume feeding, the larvae of

A. lacteicolor within them also become active and develop very rapidly at the expense of the host, which generally dies within 7–12 days after the commencement of feeding, and shortly after this the full-grown parasitic larva issues. The cocoon of *A. lacteicolor* is immediately begun, and is completed in about 3 hours. The cocoons of the wintering generation usually occur in the webs of brown-tail moth caterpillars, while those of the summer generation occur on the underside of leaves, in crevices of the bark, etc. The adult emerges from the pupa after 5 to 8 days, mating and oviposition probably occurring within 48 hours. Fertilisation is not necessary for reproduction, but unfertilised females produce only males. With regard to the summer host of *A. lacteicolor*, the gipsy moth [*Lymantria dispar*] is the only host at present known which is acceptable to the parasite and is available at the time of appearance of the adult parasites of the first generation. The life-cycle of the summer generation of *A. lacteicolor* occupies 19–20 days and adults issue from gipsy moth larvae during late June and early July. Between this date and the time of oviposition in the hibernating caterpillars of *N. phaeorrhoea* there is a period of more than a month, leaving ample time for another generation. Observations in both field and laboratory indicate *Apatela hasta* as the most probable host for *A. lacteicolor* during this period.

The importance of *A. lacteicolor* is due to several factors. It parasitises as many as 20 to 25 per cent. of the larvae of *N. phaeorrhoea*, and has several generations annually, also parasitising to a certain extent the gipsy moth and certain native injurious species, including *Datana ministra* and *Hyphantria cunea*. As its hosts are destroyed in their early stages, they are not able to do a large amount of damage before their destruction. On the other hand, the dependence of the parasite for over-wintering upon the brown-tail moth, which is now in a state of decadence, will largely reduce its usefulness as a parasite of the gipsy moth and other species. The cocoons of the first generation of *A. lacteicolor* are well protected from secondary parasites within the webs of the brown-tail moth, but among the later generations the hyperparasites found include *Monodontomerus aereus*, Wlk., *Pteromalus egregius*, Först., *Dibrachys boucheanus*, Ratz., *Dimmockia* sp., *Habrocytus* sp., *Pezomachus* sp., and two species of *Hemiteles*.

Meteorus versicolor, which is re-described in this paper, oviposits in young larvae of the brown-tail moth during August and early September, and 5 or 6 days later the larva issues from the egg and moves freely in the body cavity of its host. The larva feeds and develops very little during the autumn and passes the winter in the body cavity of its host, *Nygmia phaeorrhoea* being the only species as yet known to serve as a winter host. In the spring when the brown-tail moth larvae resume feeding, the larvae of *M. versicolor* again become active and after 10 to 14 days the cocoons of the parasite appear. The host larva generally reaches the second instar and is not killed before the emergence of the parasite, but dies about 24 hours later. The cocoons of *M. versicolor* are generally spun at a little distance from the host and are suspended from a twig or branch. The pupal period lasts 4 to 6 days, the adult emerging during the first 2 or 3 weeks of June and leaving the pupal case suspended. The adult life of *M. versicolor* is very similar to that of *A. lacteicolor*.

M. versicolor has been reared in Europe from a variety of moths. In New England the adult parasites of the first generation evidently prefer the last two stages of the brown-tail moth larvae for parasitisation. Other species occasionally attacked are *Lymantria dispar*, *Hemerocampa leucostigma* and *Orgyia* (*Notolophus*) *antiqua*; *Hyphantria cunea* has also been recorded as a host. Species that were apparently chosen for oviposition, but from which no adult parasites emerged, were *Alsophila pometaria*, Harr., *Phigalia titea*, Cram., *Xylina antennata*, Wlk., several species of Tortricids and a Tenthredinid. There is undoubtedly at least a partial third generation on various native hosts, particularly upon species of *Hemerocampa*, *Hyphantria* and other closely allied forms, early stages of which are in the field during July. Adults of this generation, together with those of other generations still living (for they may live even 2 or 3 months), oviposit in the small larvae of *Nygmia phaeorrhoea* during the early autumn.

The importance of *M. versicolor* as a parasite is much less than that of *A. lacteicolor*; it destroys only a small percentage of the hibernating brown-tail moth caterpillars. Parasitism of the nearly mature larvae of *N. phaeorrhoea* is slight, while that upon native caterpillars appears to be almost insignificant. The reasons for this lesser importance are probably dependence upon the brown-tail moth for hibernation and the fact of the cocoons being parasitised to the extent of 50 to 75 per cent. by various Chalcidoids and Ichneumonids. Many larvae of *M. versicolor* fail to pupate after having spun their cocoons, and some that occur in the same host larvae as individuals of *A. lacteicolor* are killed by the latter.

MISRA (C. S.). **The Present Conditions of Lac Cultivation in the Plains of India.**—*Agric. Jl. India, Calcutta*, xiii, no. 3, July 1918, pp. 405–415, 1 plate, 1 map.

The cultivation of lac has from time immemorial formed the means of livelihood of millions of the poorer classes of India. Lac is a resinous secretion produced by the scale-insect, *Tachardia lacca*, which sucks the juice of plants and transforms it into resin with which it completely surrounds itself. This is secreted by the epidermis, and on exposure hardens into a deep red or orange-coloured substance, semi-transparent, hard, and breaking with a crystalline fracture. The young insect on finding a suitable spot attaches itself; the males emerge from the incrustation twice a year, either as a winged or wingless form, and die after pairing. The young fertilised female, on attachment, rapidly develops, being permanently fixed by its secretion, and the lac-bearing branches are then cut off and placed on trees having a sufficient number of succulent branches. When the young insects have emerged from the incrustation on to the new host-plant, the old lac-bearing branches are removed, and the resin is scraped off, ground in a mill, soaked in water and washed. The pure animal resin thus obtained is mixed with colophony and orpiment, heated over a slow fire and drawn out into thin sheets, commercially known as shellac.

The host-plants of the lac-insect are the babul (*Acacia arabica*), the palas (*Butea frondosa*), ber (*Zizyphus jujuba*), kusumb (*Schleichera trijuga*) and mirimah, a variety of tur (*Cajanus indicus*).

The decline in the lac industry, which reached its lowest level in 1915, was followed by a rapid recovery due to fresh uses having been found for shellac, hence the present is a very opportune time to bring about necessary changes in the methods of cultivation. The antiquated system of removing lac before swarming has taken place has resulted in a shortage of the crude material, the lac insect, in spite of its prolificness not having been able to hold its own against the increase of parasites and predators. This can be avoided by removing all the lac from trees a fortnight before swarming takes place and putting it on trees already pruned for the purpose, experience having shown that produce from pruned trees is richer in resinous contents than that from unpruned trees, and that the successive broods thus reared are less liable to disease than others. Care should also be taken that only healthy brood-lac is used, and that introduced material should be only from localities comparatively free from parasites and predators, and from those having similar climatic conditions. It has also been found best to transfer brood-lac always to its own specific host-plant. The establishment of nurseries in areas at present over-run with *Butea frondosa* would render them productive and thus benefit their rural population.

Patti (M.). **Per combattere gli Afidi.** [To combat Aphids.]—*Il. Rinnovamento Economico-Agrario, Trapani*, xii, no. 6, June 1918, pp. 89-90. [Received 27th September 1918.]

This is a popular article on measures for combating Aphids injuring cultivated plants in Sicily.

Bekämpfung der Obstbaumschädlinge. [The Combating of Fruit Tree Pests.]—*Schweiz. Zeitschr. Obst- u. Weinbau, Frauenfeld*, xxvii, no. 18, 7th September 1918, p. 287.

The brown-tail moth, *Nygmia phaeorrhoea* (*Euproctis chrysorrhoea*), has appeared in some abundance on black-thorn and hawthorn hedges in various districts of Switzerland. Such hedges should be destroyed and replaced by the mulberry, where a living hedge is required.

Reports on the State of Crops in each Province of Spain.—*Bol. Agric. Técnica y Económica, Madrid*, x, no. 115, July 1918, pp. 609-630. [Received 1st October 1918.]

In Córdoba the acorn crop is considered to be totally lost owing to attack by *Tortrix viridana*. In Jaén olives have suffered from infestation by *Phloeothrips oleae*. Apple trees in the province of Madrid have been injured by *Hyponomeuta malinellus* and *Cydia pomonella*, and a leaflet is being distributed regarding these insects. In Toledo locusts have caused damage. *Clysia ambiguella* has done a certain amount of injury in Viscaya.

Work connected with Insect and Fungus Pests and their Control.—*Rept. Agric. Dept. St. Lucia 1917–1918, Barbados*, 1918, pp. 5-15. [Received 30th September 1918.]

A special visit was made to St. Lucia by Dr. J. C. Hutson in July, for the purpose of investigating the habits of *Cosmopolites sordidus*

(black weevil borer of banana) with a view to its control in that and other countries. Bananas and plantains in St. Lucia are grown chiefly in scattered clumps among the vegetable plots of peasant proprietors, in small clumps on some estates, or as the remains of primary shade or wind-belts on cacao estates. *C. sordidus* was found wherever the different varieties of bananas were examined. Young plants in their first season show no weevil infestation; the older stools, especially those in an abandoned or neglected condition, show the highest degree of infestation. All varieties were attacked, but plantains seemed to be preferred. This variety is gradually being replaced by the makabou, which it is hoped may be less susceptible to weevil attack. When plantains have ceased to produce good bunches of fruit, the clump is frequently left standing, chiefly to supply young suckers for planting; it also serves as an ideal breeding place for the weevil. A description is given of the condition of a typical neglected and overgrown stool of plantains infested by the weevil; the oldest bulb was found to be the worst infested, stumps left from cut stems had their bulbs riddled with tunnels; bulbs of stems in the early fruiting stage were usually attacked by borers in all stages of development. Young suckers of different sizes were growing all over the clump: the larger ones were sometimes slightly attacked on the side nearest the infested parent bulb, but as a rule the weevils are apparently not attracted to young suckers. Several recently planted suckers were examined for weevil grubs, but none were found. Adult weevils could usually be found in the older clumps of all varieties of bananas, generally hiding in the rubbish at the base of the stems or between the leaf-sheaths near the ground. In no instance were adult weevils found attacking young plants.

In view of these facts, it would appear that there is a period in the life of the banana plant when it is most attractive to the egg-laying weevil, this period being more or less contemporaneous with the reproductive period of the plant, during which time the bulb is being drawn upon in order to produce the future bunch and to supply the suckers with nourishment. That is, the weevil begins to oviposit on the plant about the time that the flowering shoot is in process of developing, with the bulb as a reservoir of food for the future bunch, and continues to breed in the bulb until the tissue has begun to deteriorate. This process of deterioration may be hastened by disease and by the attacks of the grubs themselves. During this period of infestation the weevil probably passes through several generations, the bulb being more and more riddled with each successive one. Unless, therefore, the banana plant gets a good start at first and is able to develop its flowering shoot at the normal time, a weevil attack, perhaps assisted by disease, will have time to injure the bulb seriously enough to prevent the development of a good bunch. If, however, the plant is kept healthy and vigorous until the bunch is well formed, it should be able to withstand an attack by the weevil, and still produce a normal bunch of fruit.

No new remedial measures against *C. sordidus* have been discovered as a result of these investigations in St. Lucia. The importance of good cultivation can only be further emphasised. It is pointed out that small growers frequently expect their plants to produce the maximum amount of fruit with the least possible attention, but this lack of attention merely results in undersized bunches that are valueless

or export purposes. The question of the best method of dealing with the infested bulb and the stem belonging to it is a difficult one. A suggestion in Jamaica was that infested bulbs should be dug up, cut into thin slices and spread over the ground [see this *Review*, Ser. A, v, p. 435]. Experiments made in St. Lucia indicated that bulbs so treated would soon shrivel, but not readily decay, and thus it is thought that they would have but little attraction for the weevil grubs. It is suggested that infested bulbs so cut up need only be left exposed to sun and rain for a few days to ensure the death of any weevil larvae; they could then be ploughed under in the ordinary course of cultivation. It is not feasible to suggest any direct methods of control until more is known about the relation of the weevil to its food-plants under Jamaica conditions. The introduction of Histerid beetles [*Plaesius javanus*] from Java suggests itself as one method of direct control that may meet with some success. No natural enemies of *C. sordidus* have been observed in St. Lucia.

The Dynastid beetle, *Tomarus bituberculatus*, was found to be fairly common in St. Lucia on the plantain and occasionally on the makabou. It was not found attacking ordinary bananas and it seems likely that the banana is less susceptible than the related species of *Musa*. It attacks young plantains soon after these are planted. The adult beetle bores into the bulb, making large tunnels in the tissue and eventually causes the death of the plant; it may also be found in the soil below the bulb. Three Scarabaeid larvae were found in the soil near the roots of a makabou banana; these may possibly be young larvae of *Tomarus* sp. This beetle also attacks tannias and dasheens before they are very far advanced, burrowing into the bulb and sometimes leaving only the part above ground. The only remedy at present seems to be to dig out and destroy the beetle and replant. One individual of *Metamasius sericeus* (striped weevil borer of bananas) was found at the base of a banana plant which was also attacked by the black weevil.

Insects attacking limes included a few adult weevils of *Diaprepes abbreviatus* var. *punctatus* found on the leaves of lime-trees on one estate. Adults, eggs and a few newly-hatched larvae were collected before they could attack the young roots on which they feed. Collection seems to be the most practicable method of control and should be practised particularly in May and June when the adults are emerging from the ground. Scales, including *Chionaspis citri* (snow scale), *Lepidosaphes beckii* (purple scale) and *Coccus viridis* (green scale) were numerous on trees that were neglected or insufficiently drained. *L. beckii* was largely attacked by the white-headed fungus (*Ophionectria coccicola*) and the red-headed fungus (*Sphaerostilbe coccophila*), while *Chionaspis citri* was occasionally found attacked by the black fungus (*Myrangium duriaei*). The Coccinellid, *Exochomus nitidulus*, was observed in the adult and larval stages feeding on these scale-insects. A small weevil found feeding upon and notching the leaves of limes has been identified as *Cyphus* (*Neocyphus*) *pudens*, Boh. It apparently emerges to feed on the leaves in the evening. The larvae probably live at the roots of some plant. Adults emerge from the ground with the first heavy rains in April or May and continue to do so for several weeks. They should be collected before oviposition can take place and should be watched for wherever citrus is grown

on the Island. Spraying with a stomach poison would only be practicable on a small scale. Two individuals of the Chrysomelid, *Homopholia aequinoctialis*, were found on limes. Mole-crickets have damaged lime seedlings on one estate as well as ruining the grass walks. It is found that where the destroyed grass is replaced by turf sods these are not attached by the insect. Poison-bait has been suggested as a check.

The larvae of the Pyralid, *Hysipyla grandella*, Zell., were found damaging the young shoots and twigs of young native mahogany trees by boring into them and stopping further growth at the point of injury. The Honduras species of mahogany is said to be preferred to West Indian mahogany, while cedar (*Cedrela odorata*) is preferred to either of these, and is frequently ruined by this moth, of which there are several generations in a year. No preventive measure is as yet known.

Watch is being kept for any appearance of *Tomaspis saccharina* (sugar-cane froghopper), which has not yet been found in the Island. A number of species of hard-back beetles have been collected and sent for identification. Young orange plants were in many cases defoliated by a species of Locustid probably of, or allied to, the genus *Microcentrum*. Nothing seems to be known of its life-history in the Islands. In California an effective control for a closely related species is to spray the trees with a stomach poison while the insects are still in the young stages, 2 lb. lead arsenate being used to 50 U.S. gals. water, but experiments would have to be made to find out the correct strength for St. Lucia conditions. If the younger stages are observed, spraying might be tried, but no further control measures can be recommended until more is known about the life-history of the insect. It has been observed that the common blackbird (*Quiscalus* sp.) hunts for, and feeds upon, the insects.

Massini (P. C.) & Brèthes (J.). **Método biológico contra las Plagas aplicado al *Oeceticus platensis*, Bicho de Canasto. Las primeras Acciones de la Campaña en su Faz práctica. La *Parexorista caridei*, Brèthes.** [The Biological Method against Pests applied to *Oeceticus platensis* (Bagworm). The first practical Measures. *Parexorista caridei*, Brèthes.]—*Anales Soc. Rural Argentina, Buenos Aires*, lii, no. 4, April 1918, pp. 207–215, 10 figs., 1 coloured plate. [Received 23rd September 1918.]

This paper describes the first campaign begun in September 1917 by the Biological Institute of the Sociedad Rural Argentina against *Oeceticus platensis* (bagworm). The senior author has previously drawn attention to the scarcity of this pest in Argentina north of the 31st degree of south latitude, and the suspected presence of efficient parasites resulted in experiments that led to the introduction into the southern regions of four species [see this *Review*, Ser. A, vi, p. 315]. Of the parasites occurring in the southern regions only one, *Tetrastichus platensis*, Brèthes, was found in the north. The work recorded in the present paper followed the same lines as before [*loc. cit.*]. In the north another new parasite was discovered, which is here described by Brèthes under the name of *Parexorista caridei*. It has been introduced into the southern zone, and the future will show whether

this and the other parasites will render *O. platensis* there as rare as it is in the north. A list of parasites known prior to these investigations is given [see this *Review*, Ser. A, v, p. 506].

MASSINI (P. C.) & BRÈTHES (J.). **La Mosca de las Frutas,** *Anastrepha fraterculus,* **Wied.** [The Fruit Fly, *A. fraterculus,* Wied.]—*Anales Soc. Rural Argentina, Buenos Aires,* lii, no. 5, May 1918, pp. 273–276, 1 plate. [Received 23rd September 1918.]

Information is given on the history of the nomenclature of *Anastrepha fraterculus*, Wied., and on its distribution. The genus is essentially an American one, more particularly tropical and sub-tropical, and about twenty species are already known. *A. fraterculus* is found in Mexico, the Antilles, Cuba, Colombia, Venezuela, Ecuador, Peru, the Guianas, Brazil, Paraguay, Uruguay, Bolivia, and in Argentina as far south as Buenos Aires. It is the species recorded in 1874 in Argentina by Weyenburgh under the name of *Anthomyia persicorum*. A description of the adult is followed by biological notes. The eggs are laid on fruits, which are mined by the larvae and fall. The larvae reach maturity in 12–15 days, drop to the ground and pupate at a depth of $\frac{2}{5}$–$\frac{4}{5}$ of an inch beneath the surface. An infested fruit may harbour half a dozen or more larvae. All cultivated and wild fruits appear to be attacked, a circumstance which hampers remedial measures. The district of Tucumán, Argentina, has just suffered from an outbreak of this pest, one of the best measures against which is a poison-spray prepared by diluting in 10 volumes of water 1 volume of the following mixture: Honey 40 parts, molasses 40 parts, sodium arsenite 2 parts, and sterilised water 18 parts. As this spray may destroy many beneficial insects it should not be used indiscriminately. The destruction of infested fruit is very necessary. An appeal is made to all who have the requisite facilities to investigate the parasites of this fruit-fly.

FULLAWAY (D.). **Division of Entomology.**—*Hawaiian Forester & Agriculturist, Honolulu,* xv, no. 7, July 1918, pp. 206–207.

During the month of May the insectary handled 30,300 pupae of the melon fly [*Dacus cucurbitae*], from which were bred 1,669 individuals of *Opius fletcheri*. The parasites distributed were:—*Opius humilis*, 214; *O. fletcheri*, 1,182; *Diachasma tryoni*, 531; *D. fullawayi*, 215; *Spalangia cameroni*, 1,050; *Galesus silvestrii*, 150; and *Paranagrus osborni*, 14,800.

EHRHORN (E. M.). **Division of Plant Inspection.**—*Hawaiian Forester & Agriculturist, Honolulu,* xv, no. 7, July 1918, pp. 207–209.

During the month of May 15 bags of Chinese rice were fumigated for an infestation of *Paralipsa modesta*, a package of rice from Manila was fumigated for an infestation of weevils, and boxwood trees from California were fumigated for an infestation of the boxwood Psyllid [*Psylla buxi*].

BEESON (C. F. C.). **Forest Entomology.**—Reprint from *Ann. Rept. Scientific Advice for India, 1916–17, Calcutta,* [n. d.], Economic Zoology, pp. 1–3. [Received 30th September 1918.]

The sal Longicorn, *Hoplocerambyx spinicornis*, Newm., was studied under insectary conditions, and an outbreak of this borer, which resulted in the death of 7,000 sal trees, was investigated in January and February 1917, remedial measures being planned for 1918. Systematic work on the early stages of *Aeolesthes holosericea,* Fairm., and of associated Longicorns of the genera *Xylotrechus* and *Chlorophorus* attacking sal has been carried out and the life-cycles have been determined in the insectary. The identification of large numbers of shot-hole borers, Longicorns and Lepidoptera infesting sal-logs is in progress.

Breeding work in the insectary yielded a series of Microlepidopterous parasites of the chir-pine scale, *Ripersia resinophila,* Green, among which are the new species :—*Batrachedra silvatica,* Meyr., *Blastobasis transcripta,* Meyr., and *Stathmopoda adulatrix,* Meyr., and consignments received yielded *Promolactis cornigera,* Meyr. Observations in chir plantations indicate that the trees are killed off by the successive attacks of the blister fungus, *Aecidium complanatum* var. *corticola,* and the weevil, *Cryptorrhynchus brandisi.*

Two new Arctiid defoliators of toon (*Cedrela toona*), *Diacrisia obliqua,* Wlk., and *Creatonotus transiens,* Wlk., were recorded ; an investigation into the life-history of *Hypsipyla robusta* was completed, and measures for its control in avenues and plantations successfully demonstrated.

The following new pests and new hosts of known pests were recorded or identified during the year : Coleoptera :—*Tiberioides kuwerti,* Arr., a borer of *Juglans regia* ; *Holotrichia longipennis,* Bl., defoliating *Quercus incana* in the Punjab ; *Heterobostrychus aequalis,* Waterh., boring into newly felled timber of *Odina modier* in Burma ; *Stromatium barbatum,* attacking plants of *Sterculia alata* and *Pongamia glabra* in the Research Institute Museum, Dehra Dun ; *Hoplocerambyx spinicornis,* Newm., boring into newly felled timber of *Shorea obtusa* in Burma ; *Sipalus hypocrita,* Boh., boring into newly felled timber of *Pinus khasya* ; and *Pachymerus* (*Caryoborus*) *gonagra,* Ol., attacking the seeds of *Prosopis juliflora.*

Lepidoptera :—*Trabala vishnu,* Lef., a defoliator of *Quercus incana* ; *Acrocercops loxias,* Meyr., bred from leaves of *Eugenia jambolana* ; and *Sitotroga cerealella,* Ol., injurious to bamboo seeds.

BURKILL (I. H.). **A Beetle which attacks Yams.**—*Gardens' Bull. Straits Settlements, Singapore,* ii, no. 1, 4th July 1918, p. 6.

This note describes the damage to the aerial bulbils of *Dioscorea bulbifera* in Singapore by a beetle of the genus *Lema* or *Crioceris,* which lives and tunnels in the mature bulbils. Eggs are laid in the tunnels and the mature larvae apparently leave the bulbils and burrow into the earth. So far no economic importance attaches to this insect because the bulbils of *D. bulbifera,* though eaten in India, Java and elsewhere, are not used in the Malay Peninsula.

BURKILL (I. H.). *Catochrysops pandava*, a **Butterfly destructive to Cycads.**—*Gardens' Bull. Straits Settlements. Singapore*, ii, no. 1, 4th July 1918, pp. 1–2.

Catochrysops pandava, Horsf., is very destructive to Cycads, *Cycas rumphii* and *C. siamensis*, in the Botanic Gardens at Singapore. Eggs are laid on the backs of still curled Cycad leaves and hatch in 3 or 4 days, the young larvae at once beginning to feed and generally moving to the upper side of the uncurling leaf for the purpose. They mature in 21 days and pupate on the back of a leaf or other sheltered place. By that time the pinnae of the leaves of the food-plants have usually been entirely destroyed and some attack has frequently been made on the fleshy axis of the leaf. Neither larvae nor adults travel far from their breeding place, Cycads not more than a quarter of a mile from infested plants having repeatedly escaped attack. No other food-plants of *C. pandava* have been found, though it seems doubtful whether the length of life of the butterfly on the wing is sufficient to fill the interval between its emergence at five weeks from oviposition and the time when the food-plant can produce new foliage. An arsenical spray is recommended as a remedy.

LEGISLATION.

Taiwan yori Kiuri oyobi Suika Inyu Kinshi no Shushi. [The Prohibition against the Export of Cucumbers and Water-melons from Formosa.]—*Imperial Plant Quarantine Station, Tokyo*, November 1917, 1 p., 1 plate.

Since the larva of the melon-fly (*Dacus cucurbitae*, Coq.) was discovered in cucumbers imported from Formosa by the Kobe Imperial Plant Quarantine Branch Station in February 1917, and as this pest might readily become established in Japan, where it does not as yet occur, the importation of cucumbers and water-melons from that island is prohibited in accordance with Section VII of the Imperial Plant Quarantine Law.

By Ordinance No. 29 of the Department of Agriculture and Commerce, published on the 23rd October 1917, the importation or receipt of cucumbers or water-melons from Formosa was forbidden on and after the 15th November 1917.

This pamphlet also contains brief accounts of the distribution, habits and destructiveness of this pest, demonstrating the necessity for this prohibition.

ENTOMOLOGICAL NOTICES.

Mr. F. H. Taylor of the Australian Institute of Tropical Medicine has been appointed Entomologist to the Special Blow-Fly Committee (Queensland) of the Federal Bureau of Science and Industry.

BEESON (C. F. C.). **Forest Insect Conditions in India.**—*Agri. Jl. India, Calcutta*, Special Indian Science Congress Number, 1918, pp. 114–121. [Received 30th September 1918.]

This paper compares the primary pests of Indian forests with those of other countries, particularly those of the temperate regions of Europe and North America.

In Central Europe the principal primary pests are mainly those of coniferous trees, the most important defoliators being:—*Lymantria monacha*, L. (nun moth), the outbreaks of which generally last for from 5 to 7 years, being accompanied by the total destruction of spruce and pine forests over wide areas; *Dendrolimus pini*, L., the most important enemy of *Pinus sylvestris*; *Bupalus piniarius*, L. (pine looper) and *Panolis flammea* (*griseovariegata*, Goetze), both dangerous defoliators of pine woods, the last outbreak of the former in 1892–96 resulting in the clear felling of over 150 square miles of pine forest in Bavaria. In the United States coniferous defoliators are not numerous, the most injurious being *Lygaeonematus* (*Nematus*) *erichsoni*, Hart. (large larch sawfly), which, since 1880, has killed off 50–100 per cent. of the mature larch over vast areas in the north-eastern United States. In Canada this sawfly has also proved to be a serious pest of *Larix americana* and other larches during the last 20 or 30 years, killing off practically all the mature trees in Eastern Canada; *Tortrix fumiferana*, Clem. (spruce budworm) has done great damage to balsams and spruces, especially in eastern Canada, and to *Pseudotsuga taxifolia* (*douglasi*) (Douglas fir) in Vancouver Island; *Neophasia menapia*, Felder (pine butterfly) has also been injurious. In British India the conifers and evergreen oaks of the mountain forests appear to be entirely free from fatal primary defoliation.

Hardwood trees in Europe are fatally defoliated, especially beech and oak, by *Lymantria* (*Porthetria*) *dispar*, L. (gypsy moth), *Arctornis chrysorrhoea*, L. (gold-tail moth) and *Nygmia phaeorrhoea*, Don. (brown-tail moth). In the United States the greatest local defoliator is *Lymantria dispar*, introduced from Europe in 1868, and now thoroughly established in forest areas. In Canada forests of both coniferous and broad-leafed trees are also threatened by *Nygmia phaeorrhoea*, introduced 12 or 15 years ago and now endemic in Nova Scotia, and epidemic in the boreal parts of New Brunswick. In British India many Lepidopterous defoliators of hardwoods are known and widespread. *Hyblaea puera*, Wlk., *Pyrausta machaeralis*, Cram., and several species of Arctiids periodically, and in some cases annually, defoliate forests of teak throughout the whole of its distribution. As complete defoliation of teak is however followed by a rapid renewal of the crown foliage or by temporary production of epicormic shoots, the injury is restricted to loss of increment and occasional stagnation.

The most important bark-borer beetle of coniferous forests in Europe is *Ips typographus*, L., other pests including the weevil, *Hylobius abietis*, L., and the cockchafers, *Melolontha melolontha*, L., and *M. hippocastani*, F. North American coniferous forests suffer from extensive invasions of the Scolytids, *Dendroctonus frontalis*, Zimm. (southern pine beetle) and *D. piceaperda*, Hopk. (eastern spruce beetle), which have killed off spruce over thousands of square miles;

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D. ponderosae, Hopk. (Black Hills beetle), *D. monticola*, Hopk. (mountain pine beetle) and *D. brevicomis*, Lec. (western pine beetle), which have killed hundreds of millions of cubic feet of timber ; and *D. pseudotsugae*, Hopk. (Douglas fir beetle) severely injuring Douglas fir. In Canada these same borers are equally destructive, the trees suffering most severely being *Pinus ponderosa*, *P. monticola*, *P. murrayana*, *Pseudotsuga taxifolia* (*mucronata*), and *Picea sitchensis*. In British India, the Himalayan conifers are attacked by species of bark-beetles allied to those of the European and American conifers, namely, *Ips longifolia*, Steb., the most destructive beetle throughout this zone of *Pinus longifolia* and *P. excelsa*, its attacks having followed on serious fires in the United Provinces. The genus *Scolytus*, confined to broad-leaved trees in Europe and America, in India attacks the deodar (*Cedrus deodara*), an outbreak of *S. major*, Steb., having occurred in 1908–10. A similar outbreak of *Polygraphus trenchi*, Steb., occurred on *Pinus gerardiana* in Baluchistan in 1903–06.

In the United States the hardwood trees such as oaks, chestnut, beech, elm, etc., are subject to the attacks of secondary heart-wood borers, such as the timber worms, *Eupsalis minuta*, Dru., and *Lymexylon sericeum*, Harr., the carpenter worms of the genus *Prionoxystus*, ambrosia beetles, shot-hole borers, and turpentine borers. In India, damage due to bark-beetles of deciduous and evergreen forest trees is undoubtedly of secondary origin and these pests do not successfully attack living healthy trees. Scolytid shot-hole and pin-hole borers are characteristic of Indian forests, as also of most tropical and semi-tropical forests, and are comparatively rare in European and North American forests. The sal (*Shorea robusta*) serves as a host for at least 27 species of *Xyleborus*, *Progenius*, *Diapus*, *Platypus*, *Crossotarsus*, etc., the technical damage being very considerable, but confined to dying and unhealthy trees. Thus an outbreak of *Diapus furtivus*, Samps., in the sal forests of Bengal was found to be secondary to that of a root parasite, *Polyporus shoreae*. Similarly an epidemic outbreak of *Crossotarsus squamulatus*, Chap., was limited to trees with diseased roots. Sal trees over two feet in girth suffer serious technical damage from the larvae of a Longicorn beetle, *Hoplocerambyx spinicornis*, Newm., which normally breeds in dying or diseased trees.

Teak, during the first few years of its life, is attacked by *Haplohammus cervinus*, Hope, and *Phassus malabaricus*, Hmps., and from the young pole stage to the end of its life by a serious pest, *Duomitus ceramicus* (beehole borer), which last, however, does not affect its vitality.

Ramakrishna Ayyar (T. V.). **The Mango Hopper Pest and its Control in South India.**—*Trop. Agriculturist, Peradeniya*, li, no. 1, July 1918, pp. 46–50.

Three species of hoppers belonging to the genus *Idiocerus*, viz. :— *I. niveosparsus*, *I. clypealis*, and *I. atkinsoni* have been recorded on mango in different parts of India. In some places one or other of the three species is found commonly, while in other areas all three are found in varying numbers. The life-history of, and remedial measures for this pest have already been noticed [see this *Review*, Ser. A, iv, p. 12 and v, p. 378].

HENRY (G. M.). **The Tobacco Aphis.**—*Trop. Agriculturist, Peradeniya,* li, no. 1, July 1918, pp. 51–52, 3 figs.

A wide-spread outbreak of an Aphid on tobacco was reported from the Jaffna district in February and March 1918, similar outbreaks having been frequent in recent years. This insect, the life-history of which has not yet been worked out, appears in numbers on the underside of young leaves or on tender shoots, causing the young leaves to become stunted and distorted. The larvae of Syrphid flies prey upon the Aphids and thus help to reduce an outbreak, though they cannot save a crop when it is severely attacked.

A treatment that proved efficacious was 1 lb. tobacco refuse boiled in 6 gals. water, 1 lb. soap being dissolved in the solution after it had stood for a night. Two applications of this by means of an ordinary syringe were made, once early in the morning and again late in the evening.

BAKER (C. F.). **Identity of a Coconut Hispid.**—*Gardens' Bull. Straits Settlements, Singapore,* ii, no. 1, 4th July 1918, p. 3.

This note corrects an erroneous identification of a small destructive Hispid beetle occurring on coconuts, that has hitherto been regarded in the Malay Peninsula as *Brontispa froggatti*, a species which was originally described from the Solomon Islands. The Malayan species has now been identified by Dr. Gestro as *Plesispa reichei*, Chap., originally described from Malacca.

BURKILL (I. H.). ***Promecotheca cumingii*, Baly, another Coconut Hispid and a Pest in Malacca.**—*Gardens' Bull. Straits Settlements, Singapore,* ii, no. 1, 4th July 1918, pp. 3–5, 1 fig.

Coconut palms in Malacca were found in July 1917 to be attacked by an insect that caused a scorched appearance in the leaves. Mature beetles were collected in December on the wing and proved to be *Promecotheca cumingi*. This Hispid beetle feeds in both the larval and adult stages on leaves of the coconut; the grubs have been found also in leaves of the nipa palm (*Nipa fruticans*) and of the sago palm (*Caryota urens*), but do not occur abundantly as yet in Malacca. The adult does not apparently fly far and spreads very little to isolated groves of coconut palms behind the coast, but seems to have the power of extending its range so long as the belt of coconuts is more or less continuous. This insect has previously been described as a pest in the Philippine Islands [see this *Review*, Ser. A, i, p. 311] and much of the information in this paper is quoted from the earlier article.

It is pointed out that control by hand-picking, which was then suggested, is impracticable on account of the height of the trees, while the same difficulty applies to the use of hydrocyanic gas. The only remedy that appears promising is to protect or increase the insect's natural enemies, for which purpose it would probably be necessary to collect a supply in the Philippine Islands.

AUCHINLECK (G. G.). **Trials with Réunion Tobacco in 1916-17.**—*Mauritius Dept. Agric., Port Louis,* Gen. Ser. Bull. no. 9, May 1917, 6 pp., 3 plates.

Experiments in growing a variety of tobacco from Réunion known as "tabac bleu," which is imported into Mauritius in large quantities, have been tried with good results; but when grown on poorer soil on a larger scale it is probable that considerable trouble will be experienced as the plants are liable to attack by various diseases and pests. Larvae of *Heliothis obsoleta* (*armigera*) considerably damaged the young plants and had to be controlled by hand-collection. Ants frequently attack the seeds, and it is suggested that the beds should be surrounded by a line of earth soaked in paraffin. A species of *Heterodera* also attacked the plants, arresting their growth and so greatly weakening them that it is doubtful whether tobacco could be successfully grown in those parts of the Island that are seriously infested by this Nematode.

WELDON (G. P.). **The Alfalfa Weevil and State Quarantine.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento,* vii, no. 8, August 1918, pp. 484–487, 2 figs.

The importation of salt grass from Utah into California for use in packing machinery and bananas having been forbidden under Quarantine Order No. 29, on the ground that it was likely to effect the introduction of the alfalfa weevil [*Hypera variabilis*], a conference of quarantine representatives has investigated the problem and offers the following solution. The material known in Utah as "salt grass packing" may be admitted into States now maintaining a quarantine against lucerne, straw and other hay from Utah owing to the presence of the alfalfa weevil, provided that such material be cut only between the 1st October and 1st April, and that the raking, stacking, baling or shipping of this material as a commercial product be allowed only after the maximum daily temperature of the season has fallen below 60° F.

The facts underlying this resolution are:—(1) the grass is unlikely to be attacked by weevils during its period of growth, which takes place on very wet land, or even under water; (2) the weevil is inactive between the dates mentioned and is therefore not likely to infest the gathered crop by flight; (3) the weevil does not fly when the temperature is below 60° F.

MACKIE (D. B.). **Some Pests we do not want, why we do not want them, and how they may arrive. ii. The Banana Root Borer.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento,* vii, no 8, August 1918, pp. 498–502, 3 figs.

Early in 1918, the introduction into the United States of all parts of banana plants used for propagation was prohibited under a quarantine order, which was promulgated owing to the appearance in Florida of *Cosmopolites sordidus*, Germ. (banana root-borer). In June shipments of banana plants were received from infested nurseries in Florida. Although banana-growing is not a staple industry in the United States, the introduction of infested plants might contribute

to the spread of *C. sordidus* in the banana-growing districts of the West Indies and Central America, and thus seriously affect the price of one of the greatest fruit commodities of the United States.

Owing to the feeding habits of this pest, there is only one successful method of control, which is by grubbing out and burning the infested stools or suckers entire. Burning, which in the ordinary sense is impossible with plants of this type, may be effected by splitting the plants and subjecting them to the heat of a powerful foundry-type blast torch that quickly chars the outside and heats the fleshy interior to a temperature sufficient to kill any larvae that may be present.

The wide distribution of *C. sordidus* in all parts of the world where the banana is grown is due to the fact that the weevil spends the greater part of its existence in the fleshy root-crown and that with the exception of a few seeded varieties, the banana is propagated by means of suckers, which are themselves the seat of infestation.

MASKEW (F.). **Quarantine Division. Report for the Month of June, 1918.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, vii, no. 8, August 1918, pp. 508–509.

The following pests were intercepted during the month of June:— From Central America: *Pseudococcus* sp., *Aspidiotus* sp., and *A. cyanophylli* on bananas; *Chrysomphalus* sp. on coconut. From England: *Coccus hesperidum* and *Cerataphis lataniae* on orchids. From Florida: Lepidopterous larvae in peppers. From Hawaii: *Diaspis bromeliae* on pineapples and *Pseudococcus bromeliae* on pineapples and bananas; Trypetid larvae in cucumbers; *Coccus longulus* on betel leaves. From Japan: *Pseudaonidia duplex* on camellia; *Ceroplastes* sp. on a pot plant. From Mexico: a Coccid on mango (tree); *Saissetia oleae, S. hemisphaerica*, an unidentified Coccid and a Scolytid on ornamental plants. From Oregon: Lepidopterous larvae on gooseberries; *Heterodera radicicola* in potatoes. From the Philippines: *Aphis* sp. on a rose tree. From Tahiti: *Lepidosaphes beckii* on limes. From Arizona: *Heliothis (Chloridea) obsoleta* in tomatoes. From Ceylon: unidentified weevils in tree seeds. From Idaho: *Rhizoctonia* on potatoes. From Massachusetts: Tetranychid mites on *Dipladenia*. From New York: *Diaspis boisduvali* on orchids and *Pseudococcus* sp. on Cape jasmine. From Louisiana: *Aspidiotus cyanophylli* and *Icerya purchasi* on bananas. From Ohio: *Pseudococcus* sp. on ornamental plants.

CALL (L. E.) & SALMON (S. C.). **Growing Wheat in Kansas.**—*Kansas State Agric. Coll. Expt. Sta., Manhattan*, Bull. no. 219, July 1918, 51 pp., 11 figs.

The best time to sow wheat in central and eastern Kansas is often determined by the Hessian fly [*Mayetiola destructor*], the presence of which can be easily detected by examining the wheat stubble. If present in abundance, there are two effective and practical ways of preventing its causing injury to the following crop. One is to kill the pupae in the stubble and in self-sown wheat before the flies can

emerge and oviposit on the grain. The other is to destroy the self-sown wheat and delay sowing so that the period of oviposition will be over by the time that the wheat is up.

The best way to kill the fly in infested stubble, in which it occurs in the "flax-seed" or pupal stage, is to plough early and at least 4 or 5 inches deep. If the ground is then worked with a disc, the pupae will be buried so deep, and the ground above packed so firmly, that very few individuals will be able to reach the surface.

Burning the stubble also kills the few pupae above the ground, but does not reach the majority that are below the surface, and this cannot be recommended as a general practice both on this account and because it destroys the organic matter in the stubble, which is badly needed in most Kansas soils.

Early deep ploughing, to be fully effective, must be practised by the entire neighbourhood, and must include all infested fields, since the flies frequently migrate considerable distances. As this is often impracticable, the only way to ensure safety is by the avoidance of early sowing. The destruction of self-sown wheat is also necessary, since if this becomes infested, it affords a place of hibernation from which the pest may spread to the fields in spring.

The dates when wheat may be sown with small chance of injury vary between the end of September and middle of October in different parts of the State. Wheat sown on or about these dates on early-ploughed and well prepared ground will usually escape attack by the Hessian fly.

Scott (R. J.). **A Farmer's Remedy for the French Bean Fly.**—*Queensland Agric. Jl., Brisbane,* x, no. 1, July 1918, p. 9. [Received 4th October 1918.]

The following simple remedy has been found successful by the author in controlling the bean fly [*Agromyza phaseoli*] and is recommended as being well worth a trial. The rows should be covered about four days after planting the seed with a light layer of sawdust, which should then be wetted with kerosene emulsion applied with a watering-can. When the plants are in the second leaf, a second dressing with this emulsion should be given. It should be made with 1 lb. ordinary soap dissolved in about 2 gals. of boiling water. When dissolved, sufficient cold water should be added to make 4 gallons and $\frac{3}{4}$ pint of kerosene should be well stirred in. The emulsion must be warm when used and must be kept well stirred.

Illingworth (J. F.) & Jarvis (E.). **Cane Grub Investigations.**—*Queensland Agric. Jl., Brisbane,* x, no. 1, July 1918, pp. 45–47. [Received 4th October 1918.]

This report again calls attention to the value of cultural methods as a factor in the control of sugar-cane grubs, and at the same time corrects some of the statements made in the previous month's report [see this *Review*, Ser. A, vi, p. 495]. Late planting in October appears to be of considerable importance for infested areas. If cane is regularly cultivated, the soil is actively worked during the flight and

oviposition of the beetles, and this seems to deter them from depositing their eggs or, if they are deposited, breaks up the egg-chambers which are only a few inches below the surface, and prevents the hatching of the young grubs. By cutting these fields late, in November or December, it is possible to ratoon them again, while little injury is apparent from grubs. Any grubs that survive the December cultivation would be destroyed by a subsequent ploughing preparatory to early planting. The importance of ploughing up all cane stubble is particularly emphasised, as it constitutes a breeding ground for all sorts of cane pests. Mauritius beans were tried as a cover crop, but did not afford complete protection.

Lepidiota frenchi has been observed to oviposit in almost any uncultivated areas where blady-grass is growing, and it is unsafe to use grass-land immediately for sugar-cane if the small grubs are very abundant during ploughing. *L. rothei* has previously been reported as occurring in considerable numbers in December and January [see this *Review*, Ser. A, vi, p. 294]. Females lay from 4 to 12 eggs about 7 to 12 days after mating; these hatch after a period of 9 to 11 days, the first larval stage occupying about 10 weeks, and the second stage about 6 weeks. Third stage larvae were obtained in breeding cages by 28th April. Among *L. albohirta*, observed on volcanic land at Meringa, 10 per cent. of the grubs, having eaten every root of cane, were devouring the last few inches of stalk still attached to the old sets, indicating that these grubs continue to feed upon such vegetable tissue as may be readily available rather than travel in search of more palatable food. The remaining 90 per cent. of larvae unearthed on this occasion had formed cells in the hard soil preparatory to pupating, 70 per cent. of these being found at depths varying from 11 to 18 inches.

Davis (J. J.). **The Relation of Agronomy to Entomology: a Practical Illustration.**—*Canadian Entomologist, London, Ont.*, l, no. 8, August 1918, pp. 253–255. [Received 12th October 1918.]

These notes are written with a view to emphasising the importance of more intimate correlation between agronomy and entomology. Illustrations of remedial measures directed against insect pests, but which are also of benefit to agriculture, are observed in the case of rotation of crops for *Diabrotica longicornis* (northern corn root worm) and for *Aphis maidiradicis* (corn root aphis). The time of sowing wheat to avoid the Hessian fly [*Mayetiola destructor*] coincides with the proper date for sowing, apart from insect prevalence, while ploughing under the stubble to destroy the summer brood of the fly is also a good agricultural practice. With regard to the control of *Lachnosterna* spp. (white grubs), many facts are adduced in evidence that May beetles will not deposit their eggs in numbers in ground that is covered with well-grown clover. The natural conclusion is to substitute clover for timothy grass in the rotation and to follow clover with maize, especially in the year following an abundance of May beetles. A rotation that is considered advisable in land infested by white grubs in northern Illinois and southern Wisconsin, and that is approved by agronomists, is oats or barley followed by clover and

maize. If oats or barley are on the ground in the year of the May beetle flight, the soil will contain many grubs, but as the following crop of clover is but little injured by them no harmful results will follow. If the ground is covered with clover during May and June of a year when May beetles are abundant, few eggs will be laid and maize can be safely grown; while if maize is grown in the year that beetles are abundant, the ground must be carefully cultivated during their flight, and in the following year barley or oats would follow, which are but little injured by the grubs.

Young (B. P.). **Ecological Notes on the Spring Canker Worm** (*Palaeacrita vernata*, **Peck**.)—*Canadian Entomologist, London, Ont.*, l, no. 8, August 1918. pp. 267–277. [Received 12th October 1918.]

A series of experiments is described with *Palaeacrita vernata*, Peck (spring cankerworm), collected from or beneath tanglefoot bands on elm trees in Kansas, where this moth had been so abundant in the preceding season as to cause complete defoliation of many trees. Tables are given recording the results. The evidence indicates that the minimum temperature at which adults can emerge from the ground is between 20° and 25° F., while an average daily temperature of about 45° F. is apparently fatal to the hatching of eggs. The average incubation period of the eggs was found to be 26 days. The number of eggs laid by each female under the conditions of the experiment was surprisingly low, being 83 on an average, though dissections have revealed as many as 400 per female. Some 20 per cent. of the eggs deposited proved sterile. It is suggested that the results of similar experiments in other localities would be interesting for comparison.

Garnett (R. T.). **An Annotated List of the Cerambycidae of California.** —*Canadian Entomologist, London, Ont.*, l, no. 8, August 1918, pp. 281–284. [Received 12th October 1918.]

This list of Californian Cerambycids, which is continued from a previous paper [see this *Review*, Ser. A, vi, p. 441] includes *Ipochus fasciatus*, Lec., taken under the bark of dead willow and oak; *Monochamus* (*Monohammus*) *maculosus*, Hald., taken from the bark of *Pinus ponderosa*; *Synaphoeta guexi*, Lec., bred from limbs of buckeye, chestnut and poplar; *Coenopoeus palmeri*, Lec., breeding in the cactus, *Opuntia*; *Dectes spinosus*, Say, breeding in stems of *Ambrosia*, especially *A. artemisiaefolia*, in which the larvae hibernate; *Hyperplatys californicus*, Casey, bred from dry twigs of *Populus monilifera* and *P. tremuloides*; *H. aspersus*, Say, bred from apple twigs; *Acanthocinus obliquus*, Lec., breeding in yellow pine; *A. spectabilis*, Lec., breeding in yellow and other pine stumps and logs; *Pogonocherus crinitus*, Lec., bred from oak; *P. oregonus*, Lec., believed to breed in fir and Douglas spruce; *Saperda horni*, Joutel, taken from willow; *S. populnea*, L., feeding on poplar; *Mecas inornata*, Say, breeding in stems of false sunflower and in *Helianthus tuberosus*; and *Oberea schaumi*, Lec., breeding in willow and cottonwood.

BEUTENMULLER (W.). **New Species of *Rhodites* from Oregon.**—*Canadian Entomologist, London, Ont.*, l, no. 9, September 1918, pp. 305–309, 1 plate.

The new gall-making species here described include *Rhodites oregonensis*, which forms galls on the twigs or entirely filling the seed-pods of *Rosa nutkana*; flies emerged from galls indoors throughout March, and galls were also found in July. *R. ashmeadi* forms galls on the stems of *Rosa nutkana*; from galls received early in February flies emerged during that month until 7th April. *R. ostensackeni* attacks the roots of *Rosa nutkana*, forming galls from which flies emerged in early April. *R. bassetti* attacks the tips of twigs of *Rosa nutkana*, forming galls which were collected in December, the flies emerging during late February until mid-March.

MALLOCH (J. R.). **Partial Key to the Genus *Agromyza* (Diptera)**—*Canadian Entomologist, London, Ont.*, l, no. 9, September 1918, pp. 315–318.

This is a continuation of a paper previously noticed [see this *Review*, Ser. A, vi, p. 328].

BAKER (A. C.). **Our Birch *Symydobius* distinct from the European. (Aphididae, Hom.).**—*Canadian Entomologist, London, Ont.*, l, no. 9, September 1918, pp. 318–320.

A study of various specimens of a species of *Symydobius* collected from birch in Ontario has led the author to the conclusion that the American form is quite a distinct species from the European, *S. oblongus*, with which it has previously been identified. It is here described as a new species, *S. americanus*.

Woodpeckers and Cacao.—*Jl. Jamaica Agric. Soc., Kingston*, xxii, nos. 2 & 3, February & March 1918, pp. 65–69 & 102–107. [Received 11th November 1918.]

A great deal of discussion having arisen as to the economic value of the woodpecker and many reports having been received of its damage to cacao pods, an investigation was made in order to compare its usefulness as an insect eater and its harmfulness to agriculture. Various local reports and letters bearing on this question are given. The second paper consists of a report from the Government entomologist, Mr. A. H. Ritchie, on the economic status of *Centurus radiolatus*, the only species of woodpecker occurring in Jamaica. The normal food of this bird consists of fruit pulp, seeds and insects. The damage to cacao is discussed, and it is suggested that it rests with the cacao grower to supply the woodpecker with fruit and seed in May, June and July, that is, during the breeding season of the bird and the months of maximum damage to cacao. The report concludes with a summary of the insects found in the stomachs of woodpeckers. Most of these are dwellers in decaying or standing timber such as the Coleoptera: *Helops mutabilis*, generally found behind the bark of trees; *Phileurus* sp., in decaying coconut stems; *Elaphidion irroratum*, a commonly occurring Cerambycid; *Lachnopus aurifer*, a weevil abundant on foliage; *Praepodes* sp., attacking breadfruit and cacao

foliage; *Scalmus interstitialis*, abundant behind decaying bark of cotton wood; and *Macraspis tetradactyla*, taken in the crowns of coconuts; as well as large numbers of cockroaches.

Black Fly on Citrus Trees.—*Jl. Jamaica Agric. Soc., Kingston*, xxii, no. 8, August 1918, p. 333.

The spread of the black fly [*Aleurocanthus woglumi*] on citrus trees has become so extensive in certain localities in Jamaica that a resolution was sent to the Government requesting the wholesale supply of a prepared kerosene or petroleum emulsion for spraying citrus trees. Investigations have led to the conclusion, however, that it is not economical, even if possible, to control this pest by spraying. It is considered that natural enemies might prove an effective control. A black ant [*Cremastogaster*] when introduced on to citrus trees sometimes clears them of the pest within a short time. There are also three species of fungi that infest this Aleurodid. Further experiments will be followed by the publication of more definite information on the subject.

MARCHAL (P.). *Stephanitis rhododendri*, **injurious to Rhododendrons in France.**—*Bull. Soc. Path. Vég. France, Paris*, iv, no. 2, 1917, pp. 93–95. (Abstract in *Mthly. Bull. Agric. Intell. & Pl. Dis., Rome*, ix, no. 8, August 1918, pp. 1011–1012.)

The occurrence is recorded in France of the Tingid, *Stephanitis rhododendri*, Horv., a pest of rhododendrons, probably imported from Holland three or four years ago. The damage, which is done chiefly in June and July, is similar to that caused by *S. pyri*, F. The eggs, which are laid in late July or early August on the thick part of the under-surface of the leaf, hibernate in that state and hatch in the following spring, the adult being mature and able to migrate to other plants three months from the time of hatching. In Holland there is only one generation in a year. Successful treatments have been given of nicotine sprays mixed with 2 per cent. soap and 1 per cent. spirit. Soap or pyrethrum are also used as sprays, and should be applied frequently to the under-surface of the leaf early in spring before the insects have become winged. The soil should be turned with a spade after treatment. Fumigation is also recommended [see this *Review*, Ser. A, vi, p. 443]. Only healthy stock should be used and young plants when transplanted should be carefully examined and all leaves attacked by the insect should be picked off and burnt.

DEL GUERCIO (G.). **Cecidomyid Flies living on** *Olea chrysophylla* **and** *O. europaea*, **in Eritrea and Italy respectively.**—*Agricoltura Coloniale, Florence*, xii, no. 2, 1918, pp. 65–102, 35 figs. (Abstract in *Mthly. Bull. Agric. Intell. & Pl. Dis., Rome*, ix, no. 8, August 1918, pp. 1012–1013.)

The following new species of Cecidomyids are described from larvae or pupae in the absence of adults:—*Rhabdophaga oleiperda* attacks young branches of *Olea chrysophylla* in Eritrea, the larvae causing galls which eventually kill the branches attacked or render them sterile. The larvae are attacked by an ectoparasitic Chalcid

which seems to be largely instrumental in controlling the insect. *Hormomyia oleiphila* in the larval stage forms galls on the leaves of *O. chrysophylla* or on the extremity of the petioles. An ectoparasitic Chalcid has been observed and may be an effective control. *Radulella aureocephala, Perrisia chrysophyllae, P. proxima* and *P. verrucosa* all form leaf galls on *O. chrysophylla.*

The larva of *Lasioptera carpophila* is described from an individual found in the fruit of *O. europaea* in the Province of Teramo, and a larva which is probably identical has been observed in olives from Promontorio Garganico. The author takes *Dasyneura lathierei* and *Lasioptera kiefferiana,* which in Italy attack *O. europaea,* as types of two new genera *Gioliella* and *Gastinella* respectively. It is most important that these insects should not be allowed to pass from one continent or district to another. Although it has not yet been proved that *R. oleiperda,* which is considered peculiar to *O. chrysophylla* and is economically the most important of these species, can also attack the common olive, the mere possibility of its introduction from Eritrea is sufficient to justify precautions until the contrary has been proved. The same applies to *Gioliella lathierei* and *Gastinella kiefferiana.* When any of these species occurs in large numbers, the plants attacked should be pruned and the diseased branches topped and immediately burnt. As topping prevents harvesting in the year in which it is carried out, it is best to prune and to spray abundantly with lime water, calcium polysulphide or lime-sulphur mixture, preferably with the addition of a little flour to render the spray more adhesive.

Scott (E. W.), Abbott (W. S.) & Dudley, Junr. (J E.). **Results of Experiments with Miscellaneous Substances against Bedbugs, Cockroaches, Clothes Moths, and Carpet Beetles.**—*U.S. Dept. Agric., Washington, D.C.*, Bull. no. 707, 26th August 1918, 36 pp.

Experiments to test the value of various materials as insecticides against *Phyllodromia* (*Blattella*) *germanica*, L. (common cockroach) were arranged in two series: cage tests and room tests.

Any powdered substance applied to a cockroach, or through which it may crawl, is taken into the mouth, owing to the insect's habit of frequently cleansing its legs and antennae by drawing them through its mouth-parts. In this way any poison, whether distasteful or not, finds its way into the stomach, and therefore there is no necessity for an attractive bait. Of all the substances tested, sodium fluoride was found to be the most effective, acting both as a stomach and contact poison, and killing 100 per cent. in cage tests in 24 hours, even when the material was diluted down to 18 per cent. Practically 100 per cent. were killed in kitchens by the use of a mixture containing 50 per cent. of sodium fluoride.

Pyrethrum powder, made from open, half-open or closed flowers, either wild or cultivated, and kept from 1 to 4 years, killed practically all the insects in cage tests within 48 hours. Its effectiveness was greatly reduced by being slightly diluted, even with ground pyrethrum stems, which have no insecticidal value.

Borax, as an insecticide, acts very slowly, and satisfactory results can be obtained only by the repeated and persistent use of the material.

Its action is primarily that of a stomach poison. Not less than 12 per cent. borax, in combination with inert matter, required from 3 to 7 days to kill 100 per cent. of the insects in cage tests.

Phosphorus pastes were partly effective in cage tests, and only slightly so in room tests.

The various hydrocarbon-oil sprays, undiluted, killed from 80 to 100 per cent. in treated cages, and similarly coal-tar creosote emulsions, undiluted, killed 100 per cent. in cage tests, but their effectiveness fell very rapidly when even slightly diluted with water.

Substances tried but found ineffective were:—Tobacco powders containing as much as 5·26 per cent. nicotine; plaster of Paris and flour mixture; and 38 miscellaneous materials, including camphor, eucalyptus leaves, gypsum, lime, quassia, sodium carbonate, Cayenne pepper and sulphur.

Fumigation with sulphur, at the rate of 9 oz. sulphur to 1,000 cubic feet, was effective; but nicotine, at the rate of 8 oz. tobacco extract (40 per cent. nicotine in the form of sulphate) to 1,000 cubic feet, was not so.

The two important species of clothes-moths occurring in the United States are *Tineola bisselliella*, Hum., and *Tinea pellionella*, L. In experimental work the former species was used exclusively on account of its abundance in Washington, its larger size, and the fact that it readily leaves its case when disturbed.

In addition to a number of cage tests, which are described in detail, several room and trunk experiments under more nearly practical conditions were made against the adults. The results showed that naphthaline was uniformly effective in protecting woollens from infestation and in killing all stages of the insect, the same being true of camphor to a less extent. A red-cedar chest killed all adult moths, and showed considerable killing effect upon young larvae. It did not prevent the hatching of eggs, but killed the resulting larvae immediately. Red-cedar chips and shavings protected flannel from injury when used liberally, but had no effect upon eggs, or upon larvae when more than one-fourth grown. Pyrethrum powder readily killed the larvae, and various mixtures of oils were effective in protecting clothing from infestation, when used undiluted or slightly diluted, and when used undiluted they killed 100 per cent. Laundry soap in strong solutions killed both larvae and eggs, and powdered cloves, sodium fluoride, and 95 per cent. alcohol, undiluted, killed the larvae.

Paradichlorobenzene was not effective against adults and larvae in a room fumigation test lasting 21 hours, but effectively killed larvae in battery-jar tests. Various tobacco extracts used at reasonable strengths were valueless. Lavender flowers, Cayenne pepper and all-spice were ineffective, but clover and oil of lavender were effective in protecting flannel from infestation by the adults. All-spice, angelica root, black pepper, borax, Cayenne pepper, colocynth pulp, eucalyptus leaves, formaldehyde, hellebore, lead carbonate, lead oxide, quassia chips, sodium bicarbonate and sodium carbonate were valueless against the larvae. Borax, salt and sulphur did not kill the eggs, which were, however, destroyed by ethyl alcohol in 50 per cent. and 70 per cent. solutions, and also by a 16 per cent. solution of formaldehyde.

Fumigation with sulphur effectively destroyed both adults and larvae, and heat killed both larvae and eggs placed in an oven for 31 minutes at a temperature of 110° F. Larvae and eggs in infested flannel were destroyed by dipping the flannel for 10 seconds in water at 140° F.

Two species of carpet beetles, *Attagenus piceus*, Oliv., and *Anthrenus scrophulariae*, L., attack heavier fabrics, such as carpets and blankets in the United States. The former, on account of its greater abundance, was used in the experimental work. Naphthaline and camphor effectively prevented infestation of clothing and killed all stages of the beetle, though the action of camphor was much slower. A red-cedar chest killed adults and newly-hatched larvae, but had no effect on larvae half-grown or larger, while red-cedar chips were only moderately effective against the adults. Pyrethrum powder was much less effective against carpet-beetle larvae than against those of the clothes-moth. The larvae were killed by various mixtures of mineral oils, either undiluted, or only slightly diluted, and both larvae and eggs were killed by laundry soap in strong solutions. Ethyl alcohol (50–95 per cent.), powdered cloves, gasoline, mercuric chloride, and fumigation with sulphur (8½ oz. to 360 cu. ft.) killed the larvae effectively. Nicotine solutions and tobacco powders were of no practical value, and ethyl alcohol (20 to 40 per cent.), allspice, arsenious acid, borax, formaldehyde fumigation, hellebore, lavender flowers, lime, black pepper, sodium fluoride and sulphur were all ineffective against the larvae. Oil of cedar leaves was effective, and lavender flowers ineffective, in protecting flannel from infestation. The eggs were killed by ethyl alcohol (30, 50, 70 and 100 per cent.), but not by borax, gasoline, mercuric chloride and sulphur. Heat killed the larvae when exposed in an incubator to a temperature of 120° F. for 30 minutes. A higher temperature was needed to kill the eggs. Larvae and eggs on infested flannel were killed by dipping it for 5 seconds into hot water at a temperature of 140° F.

The part of this bulletin dealing with bedbugs is noticed elsewhere [see this *Review*, Ser. B, vi, p. 240].

De Weever (P. M.). **Bee-keeping in British Guiana.**—*Jl. Brit. Guiana Bd. Agric., Georgetown*, xi, no. 3, July 1918, pp. 86–96.

Eciton burchelli, Westw. (Yakman ant) is the most important enemy of the honey-bee in British Guiana. For days preceding an attack the ants gather in swarms near the hive, and when the time comes, swarm up the legs of the stand, and by sheer force of numbers overpower and kill the bees. Bee-keepers may prevent an attack by lighting a fire to windward of a hive and feeding it with green grass and leaves. The dense smoke causes the ants to drop to the ground where they may be killed by surrounding them with a ring of fire. The surviving bees that have remained clustered round their queen should then be placed in a fresh box and fed with syrup.

Weakening of a colony due to the attacks of robber-bees induces attack by *Galleria melonella*, L. (bee-moth), in which case the entrance to the hive must be contracted and the bees fed. Badly infested combs should be melted down and fresh ones put in their places, the bees being fed on a sugar syrup, not on honey.

Bodkin (G. E.). **A Note on the Recent Froghopper Outbreak.**—*Jl. Brit. Guiana Bd. Agric., Georgetown*, xi, no. 3, July 1918, pp. 96–97.

Tomaspis flavilatera, Urich (Demerara sugar-cane froghopper) has increased enormously in numbers during recent months in three widely separated districts, owing to the abnormal climatic conditions obtaining. Continued heavy downpours of rain caused the soil to become waterlogged, and the canes were backward and even stunted. The pest under these favourable conditions did such damage, that the only treatment possible was thorough flooding after total destruction, by fire or otherwise, of the trash.

Good results were obtained by children collecting the adults with hand-nets in the cane-fields during the daytime. The use of trap-lights and the introduction of the green muscardine fungus [*Metarrhizium anisopliae*] should also prove beneficial.

The Food of Australian Birds.—*New South Wales Dept. Agric., Sydney*, Sci. Bull. no. 15, July 1918, 112 pp. [Received 7th October 1918.]

In this Bulletin, which has been compiled from the investigations of J. B. Cleland, J. H. Maiden, W. W. Froggatt, E. W. Ferguson and C. T. Musson, is incorporated a great deal of information from various sources regarding the food of wild birds in Australia. In an introduction by Dr. Cleland it is explained that the data collected, which include much information obtained in the course of blow-fly investigations, should prove of value to breeders of sheep, as well as to orchardists, wheat growers, gardeners and those in charge of forestry work The facts have been arranged in various ways for the convenience of those consulting the bulletin. There is a short summary of the food of, and a verdict on, various birds or groups of birds, in the order of their importance. This is followed by lists of birds that feed on particular kinds of food of more or less economic importance, and these include both injurious and beneficial species. An appendix gives a tabulated examination of the contents of the stomachs and crops of each species of bird examined, while more detailed information in further appendices shows the actual food found in the case of each individual.

Miller (D.). **Limitation of Injurious Insects by Beneficial Species.**—*New Zealand Jl. Agric., Wellington*, xvii, no. 1, 20th July 1918, pp. 12–18. [Received 8th October 1918.]

It is a well-known fact that when new territory is opened up for agricultural purposes it frequently happens that new conditions are established favourable to the development of some indigenous insects, the ravages of which rapidly increase until their control becomes a serious problem. The reason is that in older countries, where regular cultivation has been carried on for a long period of years, an equilibrium has been established between the injurious insects on the one hand and their natural enemies and other controlling factors on the other.

An illustration of this is *Xanthorhoe praefectata* (New Zealand flax moth), the larvae of which confine their attention normally to flax [*Phormium tenax*] growing in comparatively dry conditions. As the flax industry in New Zealand extended, swamp areas were drained comparatively dry and covered with a growth of flax, with the result that the moth, being provided with abundance of food under suitable conditions, increased with alarming rapidity. The larvae of *X. praefectata* are heavily parasitised by an Ichneumonid, which is itself limited by a hyperparasite, and it is probably the factors controlling the hyperparasite which influence the abundance of the larvae of *X. praefectata*. A chart shows the relation of *X. praefectata* to primary and secondary parasites. Similar instances of indigenous phytophagous insects developing injurious tastes are those of *Melanchra composita* (New Zealand army worm) and *Odontria* spp. (New Zealand grass-grub beetles). The natural food of *M. composita* consists of native grasses, though it occasionally attacks oat crops in large numbers. Very little is known of the *Odontria*, but their life-histories are being studied.

While a certain amount of damage is caused to cultivated areas through the depredations of native insects, far greater loss is caused by injurious species accidentally imported from other countries. These insects rapidly increase under new conditions in the absence of their natural enemies. A notable example of this is *Eriococcus coriaceus* (gum-tree scale), a native of Australia, where it does little damage owing to the presence of natural enemies. The first outbreak of this scale in New Zealand was noticed in 1900, when great destruction was caused, and by 1905 the insect had spread north and south for a distance of 180 miles, killing many trees and causing great damage. Coccinellids that were known to control the scale in other territories were then introduced from North Auckland and from Australia, *Rhizobius ventralis* being the most effective in Canterbury, where it became so well established that within three years *E. coriaceus* had been reduced to a negligible quantity. It is found that when a predaceous insect begins to reduce an outbreak of its host, although the latter is superior in numbers and fertility, it will in a few generations be in excess of its host. In the case of a parasite confined to one host, however, the excess of the latter will of necessity disappear owing to lack of sufficient food, until only enough remain to retain the normal equilibrium.

Oligotropus alopecuri (meadow foxtail midge) by its depredations upon the developing seed of the meadow foxtail grass has produced a serious situation [see this *Review*, Ser. A, v, p. 165]. Before the midge was considered an important pest, there was every likelihood that sufficient quantities of the seed would be produced in New Zealand for local and export purposes. Owing to this pest, which was probably imported in seed from Europe, there is now no seed grown in one district where formerly the output was 18 tons annually. Infestation was first noticed in 1910; by 1915, 70 per cent. of the seed was rendered useless, and in the following year this percentage was even higher. It is known that early settlers in the Dominion were able to grow various exotic fruits without loss from insect pests. In later years, however, these became so well established that fruit-growing threatened to come to an end. Organisation and the

application of remedial measures have now succeeded in checking the pests to such an extent that the fruit industry is again rapidly developing.

It is obvious that the introduction of the natural enemies of imported pests from their original habitat would be an invaluable factor in the control of injurious species, perhaps more so than in their native country where they themselves are subject to controlling influences. When a phytophagous insect attacks one species of plant more than another, efficient results may be obtained by a thorough system of crop rotation, while attention should be paid at the same time to places suitable for hibernation, such as the rank grass usually fringing cultivated fields. In this way, by breaking the continuity of the food-supply, the life-cycle of the insect is interrupted, and the removal of hibernation quarters will destroy a large proportion of the over-wintering stages, with a consequent reduction of the spring brood.

JACK (R. W.). **Cutworms.**—*Rhodesia Agric. Jl., Salisbury*, xv, nos. 3–4, June–August 1918, pp. 225–237 ; 344–348, 2 plates, 1 fig.

Cutworms constitute one of the most destructive plant pests in Southern Rhodesia on account of the variety of crops they damage. They are frequently confused with Elaterids (wireworms), of which the most familiar in Southern Rhodesia are *Psammodes* spp., which live in the ground and feed upon the underground portions of plants, being particularly injurious to tobacco, and with white grubs [Lamellicorn larvae] which feed upon the roots of maize, small cereals and grasses.

Four species of cutworms have been recorded in southern Rhodesia. *Euxoa segetum* is the commonest and is well-known in Europe; *E. longidentifera*, Hmps., is a purely African species, only found in company with *E. segetum*, and has not as yet proved very dangerous: *E. spinifera*, Hb., extends from southern Europe to the Cape and India. It is scarcely considered a pest in Rhodesia and is usually found in company with *E. segetum*. *Agrotis ypsilon*, Rott., sometimes occurrs in overwhelming numbers, but is sporadic in its outbreaks. The adults of all these species are nocturnal and lie hidden in sheltered places during the day. Oviposition begins about four days after emergence, the eggs being laid among low-growing vegetation, attached to the stems of plants, to stones, lumps of earth, etc. As many as 1,766 eggs were laid by a single female of *E. segetum* in confinement. There are six larval instars; the young cutworms feed chiefly upon leaves and other soft tissue within their reach, keeping mainly under shelter during the daylight; later they develop the habit of burying themselves in the soil during the day, and feeding at night. The chief damage is done by eating through the stems of plants at the ground level. The larval period, under summer conditions with unlimited food, lasts about 29 days, the average time being a few days longer; in cold weather the growth may occupy several months. In temperate climates attacks on young crops in the spring are due to cutworms that have hibernated in a partly developed condition, the low temperatures having suspended the vital processes in the caterpillars so as to prevent starvation. In Rhodesia starvation supervenes very quickly during winter if no food is available and the

higher the temperature the sooner the insect succumbs. Experiments showed that cutworms died within about ten days if kept without food during the summer months. The existence of the larvae is considerably prolonged if dry maize stalks are left on the land. It is obvious that the cutworms hatching from eggs laid about May cannot be destructive to the next season's crop; they must either pupate during the dry season or die of starvation. Pupation takes place an inch or two below ground level, emergence of the moth occurring in two or three weeks in the summer. The generations of cutworms are quite irregular throughout the year. Adults have been reared during every month, but they are most numerous in January and early February. In summer the life-cycle may occupy a minimum of 50 days; in the field in Rhodesia there are probably four complete generations of *E. segetum* during the year, as compared with one only in the British Isles and similar climates. Cutworms will eat almost any growing plant that is not too hard or woody, but their preference is for potato, tobacco, maize, lettuce and grasses of a particularly succulent nature.

There are various factors in Rhodesia that tend to check the increase of cutworms, though they are not sufficient to keep the pest in constant subjection. The climate undoubtedly encourages a number of generations during the year, but the prolonged dry season has an adverse effect. The warmth of Rhodesian winters favours the development of the insect at a time when food-plants are exceedingly scarce. Epizootics of disease are common among cutworms, particularly during the latter half of the wet season (February and March), and it may be found possible to cause the spread of these artificially. Insectivorous birds and mammals undoubtedly exercise a considerable measure of control over cutworms, although the habit of burrowing into the soil during daylight affords the larvae a certain measure of protection. Predaceous insects include the ant, *Dorylus helvolus*, and its allies. An Asilid fly has also been observed to attack the adult moth. Parasites bred from *E. segetum* include at least five species of Tachinids, four Ichneumonids and one Braconid. The most persistent cutworm parasite appears to be the Tachinid, *Gonia bimaculata*, Wied., which has been reared from cutworms in several localities, but has not been bred by the author from any other host. Another common species is *Wagneria nigricans*, Meig. There are unfortunately many practical difficulties in the way of utilising natural parasites for control of cutworms. Their action is too slow to control the sudden outbreaks that occur, though they may reduce subsequent generations. The Tachinids that are the most efficient parasites have not as yet been successfully reared in confinement, and even if this method proved possible, it would require a large amount of labour to attain very uncertain results.

The influence of various classes of cultivation and of different kinds of soil in relation to outbreaks of cutworms is discussed. Green vegetation is very scarce in Rhodesia during the dry season; wherever this is found, therefore, cutworms are likely to concentrate. Rich, low-lying land that quickly develops a crop of weeds after a few early showers is very liable to attack. The use of kraal manure, by increasing the humus content of the soil, encourages cutworms. In small areas, such as kitchen gardens, cutworms may continue to be

abundant throughout the year, owing to the attractive nature of the plants that are cultivated in such situations.

The second part of this paper discusses preventive measures and remedies for cutworms. Attacks on irrigated crops, such as potatoes, during the dry season, cannot well be guarded against, as eggs are laid on the crop itself; but clean cultivation and the keeping down of weeds are obviously helpful in checking the numbers of the pest; heavy loss is especially likely to be experienced if weeds are allowed to grow for a time and are then destroyed by cultivation, leaving only the cultivated crops for the cutworms to feed upon. Tobacco seedlings should be carefully protected by covers, leaving no aperture through which a moth could enter. A fairly wide space of bare ground around the seed beds would help to check invasion. Preventive measures in regard to wet season crops consist mainly of keeping the land as free from weeds as possible before the crop is planted. This will prevent oviposition. Planting with the first rains tends to avoid serious loss from cutworms, but is not recommended for maize, which when planted early is likely to suffer from borers.

Remedies for cutworms are numerous, the one almost universally recommended being poisoned bait. Many experiments to determine the efficacy of various baits have been carried out, *E. segetum* being the species mainly tested. The results were somewhat contradictory, but certain conclusions were arrived at. Sodium arsenite is not a suitable poison for larvae of *E. segetum*, as owing to its distastefulness, sufficient to cause death is seldom eaten. The larvae are not sufficiently attracted by baits made with bran or maize meal. *A. ypsilon* and *E. longidentifera* are more readily poisoned by standard baits than *E. segetum*. All species are readily poisoned by succulent green stuff dipped in Paris green and water (1 lb. to 10 gals.) with or without sugar. Small individuals of all species are more easily poisoned than larger ones, but no bait is known that will attract cutworms away from favourite food-plants. To obtain the maximum effect, the ground should be free from growing plants when the bait is used. Land planted with maize should be baited twice, just before the crop is due to appear above ground. When tobacco plants are attacked in the seedling-leaf stage by very small cutworms, the whole might be sprayed with 1 lb. lead arsenate in 16 gals. water, adding 1 lb. sugar or 1 pint molasses to each gallon of the liquid. Paris green may be used in the same way, 1 lb. to 160 gals. water with the addition of 1 lb. lime. When the young plants have begun to grow freely, this method is useless, as they are usually cut through at the ground level while the poison remains on the leaves. Under these conditions hand-picking is the only remedy.

A table records the results of many experiments with various poisoned baits and the conclusions are discussed in an appendix.

SPEYER (E. R.). **Report on the Work of the Entomological Division, including Special Investigations into Shot-hole Borer of Tea.**—*Ceylon Administration Reports for 1917, Dept. Agric.*, 11th February 1918, pp. C 10–13. [Received 17th October 1918.]

Icerya purchasi (fluted scale) was found to be increasing upon *Acacia decurrens* and other hosts and necessitated some attention,

particularly as tea was attacked in a few instances. It was decided to import *Novius (Vedalia) cardinalis* from South Africa. The cut-worm, *Agrotis ypsilon*, was troublesome on vegetables; experiments with traps and poison-bait are being carried out. Two beetles, *Necrobia rufipes* and *Silvanus surinamensis*, were reported as doing serious damage to stored copra. Scolytid beetles were studied in various trees and plants, especially with regard to their attacks on tapped surfaces of rubber treated with tar and liquid fuel. *Coccotrypes dactyliperda*, F., enters the nuts of *Myristica fragrans* (nutmeg) and *Xyleborus compactus*, Eich., affects the growth of coffee.

Miscellaneous pests recorded include: —On tea: *Zeuzera coffeae* (coffee borer); *Euschema palmyra*; *Calotermes militaris*; *Oscinis theae*; *Coccus (Lecanium) viridis* (green bug); *Saissetia (L.) hemisphaerica*; *Toxoptera coffeae (Ceylonia theaecola)*; *Acheta bimaculata*; *Tarsonemus translucens*; *Brevipalpus obovatus*. On rubber: *Comocritis pieria*; *Coccus viridis*; *Saissetia (Lecanium) nigra*; *Batocera rubus*; *Ceratina viridis*. On coconuts: *Nephantis serinopa*; *Aularches militaris* (spotted locust). On cacao: *Comocritis pieria*; *Arbela quadrinotata*. On rice: *Marasmia bilinealis*. On sugar-cane: *Argyroploce (Grapholitha) schistaceana*; *Proutista (Phenice) moesta*; *Pyrilla aberrans*. On cotton: *Sylepta derogata*; *Dysdercus cingulatus*. On vegetables: *Agrotis ypsilon*; *Plutella maculipennis*; *Crocidolomia binotalis*; *Dorylus orientalis*. On mustard: *Crocidolomia binotalis*. On beans: *Riptortus pedestris*; *Agromyza phaseoli*. On litchi: *Tachardia albizziae*. On plantain: *Odoiporus longicollis*. On dadap: *Suana concolor*; *Terastia meticulosalis*; *Acherontia lachesis*; *Spalgis epius*; *Pseudococcus (Dactylopius) citri*; *P. (D.) crotonis*; *Anoplocnemis phasiana*. On *Albizzia*: *Terias silhetana*. On *Cassia grandis*: *Duomitus leuconotus*. On *Cedrela toona*: *Hypsipyla robusta*. On giant bamboo: *Oregma bambusae*. On rose: *Icerya aegyptiaca*. On *Cycas*: *Ceroplastes floridensis*.

Special investigations have been carried on with regard to *Xyleborus fornicatus*, Eich. (shot-hole borer of tea). Specimens have been received from Bangalore in castor-oil plants, thus supporting the view that it is the true host of this beetle. *X. fornicatus* has now been recorded in twenty-three different plants belonging to the same number of genera, only three of which are native to Ceylon. Experiments to determine the depth to which prunings must be buried in order to prevent escape of the beetles have shown that a larger number escape from prunings at a depth of 2 ft. 6 ins. than at 2 ft., 9 ins., or 6 ins. It is found that the methods of cutting across or slashing when bringing tea into bearing are most conducive to severe attack and render any control in such tea very difficult. Attempts are being made to find a suitable paint for application to bushes after pruning so that adult beetles may be killed without injury to the plant. Coconut oil and resin have been used in combination with other substances and gave good results, but are too expensive for use on a large scale. Other oils are being experimented with. Branches of *Terminalia catappa* were tried as traps, and while only a few borers were present in the adjacent tea, a few beetles were attracted to the branches. This is the only decaying tree that *X. fornicatus* is known to breed in, besides cacao. It is proposed to carry out further experiments with this tree and with castor-oil plants as traps.

JARDINE (N. K.). **Special Investigation into Tea Tortrix.**—*Ceylon Administration Reports for 1917, Dept. Agric.*, 24th January 1918. [Received 17th October 1918.]

A complete bibliography of *Homona coffearia* has been compiled. Food-plants, other than tea, include *Eucharis grandiflora*, *Cinnamomum camphora* (camphor), *Persea gratissima* (avocado pear), *Acacia decurrens*, *Erythrina lithosperma* (dadap), *Pithecolobium saman*, *Eucalyptus robusta*, *Psidium cattleyanun* (red guava), *Grevillea robusta*, rose, cacao, *Artocarpus integrifolia* (jak) and *Duranta plumeri*. It has also been recorded by planters on *Citrus*, *Pelargonium*, *Acalypha*, *Stephanotis*, chrysanthemum, Michaelmas daisy, sword bean and cow bean. The life-history of this moth has been worked out in the laboratory and a detailed account will be published. The effect of climate has been very noticeable. Heavy and continuous rain appears detrimental to the propagation of the insect. Larvae that have completed the final moult apparently pupate prematurely in an endeavour to escape the harmful conditions. Of these premature pupations, 75 to 85 per cent. give rise to males. This is probably one of the reasons why in excessively wet weather *H. coffearia* practically disappears, there being too small a proportion of females to continue the race. Many of the larvae die off during wet weather of a disease brought on by excessive moisture; whilst others are attacked by several species of fungi, including a yeast which was apparently the cause of an epidemic among them. Infestation is most marked during the driest period, February-June. As the south-west monsoon is responsible for a general distribution of the pest, it has been suggested that dadap trees should be planted along the south-west ridges to break the advance of the adult moths, and act as a trap from which eggs and larvae may be collected. Many experiments have been instituted to ascertain the variation of metamorphosis according to altitude and locality.

With regard to parasites, those of the egg include *Trichogramma australicum*, and *T. minutum* or *Trichogrammatoidea* ? *nana*. Two species of *Proctotrupes* are also parasitic on it, while *Ophion bicarinatus*, *Phytodiactus capuae* and a Syrphid have been hatched from larvae of *H. coffearia*, and a Chalcid of the genus *Leucospis* from the pupae. The value of predaceous insects, birds and bats is being investigated. Mason wasps have been observed to carry off a number of larvae from the curled leaves. Birds do not apparently reduce the numbers of *H. coffearia* to any appreciable extent; on the contrary, by devouring its parasites they tend to benefit the pest.

SPEYER (E. R.). **Shot-hole Borer of Tea. Extract from Qtrly. Rept. of the Entomologist, April-June 1918.**—*Trop. Agriculturist, Peradeniya*, li, no. 2, August 1918, p. 102.

Experiments have shown that adults of the shot-hole borer of tea [*Xyleborus fornicatus*] emerge from buried prunings in dry weather in considerable numbers. No manure in ordinary use prevents the escape of beetles from prunings, and in dry weather it is considered better to leave prunings on the ground than to bury them. In wet weather, when the earth above the prunings received the normal rainfall, adults emerged in small quantities as before, even when they

were buried with a considerable quantity of nitrolim. It is obvious from these experiments that the burial of prunings at a depth practicable on estates is rather an encouragement than a check to the increase of the insect. Experiments with paints and sprays indicate that coconut oil cannot be used in any form of emulsion against *X. fornicatus* owing to its effect upon the tea bushes. Dilutions of the emulsion with 90 per cent. of water had similar bad effects. A mixture of Ceylon soap and resin in equal proportions with the addition of fish-oil gave a successful emulsion. A similar mixture prepared by the Government Fisheries Department at Tanur was effective when additional resin was used. It is hoped that this mixture may be obtained in large quantities from India and may prove successful when applied to pruned bushes as a paint in concentrated form and to the lower parts of unpruned bushes as a spray.

Fluted Scale (*Icerya purchasi*).—*Trop. Agriculturist, Peradeniya,* li, no. 2, August 1918, p. 102.

In the quarterly report of the acting entomologist for April-June 1918, a serious outbreak of *Icerya purchasi* on *Acacia* was recorded in the Dimbula district, Ceylon, and was summarily dealt with. *Novius* (*Vedalia*) *cardinalis* was received from South Africa, but the importation was unsuccessful owing to the length of time occupied on the journey.

Swaine (J. M.). **Studies on the Relation of Forest Insects and other Factors to Forest Regeneration.**—*Agric. Gaz. Canada, Ottawa,* v, no, 9, September 1918, pp. 860–861.

The influence of forest insects upon the mortality of developing timber is being studied. This is recognised as a serious question in view of the small proportion of balsam and spruce trees in Eastern Canada that attain a second growth yielding timber of any size or value. The important insects affecting spruce are *Polygraphus rufipennis,* Ky., as well as several other species of bark-beetles, and *Tortrix* (*Harmologa*) *fumiferana,* Clem. (spruce budworm). Those affecting balsam [*Abies balsamea*] are *Pityokteines sparsus,* Lec. (*Tomicus balsameus*) (Eastern fir bark-beetle), a species of *Pissodes* and *T. fumiferana.* If it should prove that bark-beetles cause a large percentage of the excessive mortality, as they are believed to do, it ought to be possible to avoid much of the loss by slash burning and utilising the slash as a trap for destroying the swarms of beetles attracted to it during the first summer following the cutting. A series of experiments has been initiated by which it is hoped to obtain the percentage of dying trees killed by insects as the trees develop, and the percentage of these killed by individual species of insects, with details of their habits. It would also be discovered exactly how effective slash burning is in checking the insects infesting young growth.

Jack Spaniards.—*Agric. News, Barbados,* xvii, no. 427, 7th September 1918, p. 279.

It is reported that *Polistes annularis* (Jack Spaniard), introduced into Montserrat from St. Vincent in 1910, has been plentiful for

several years in the district where it was first established, and is also spreading. The establishment of this wasp is of considerable interest as it has proved valuable in keeping the cotton worm [*Alabama argillacea*] in check.

SHERMAN (F.) & LEIBY (R. W.). **The Fall Army-Worm.**—*North Carolina Agric. Exten. Service, W. Raleigh,* Circ. no. 79, September 1918, 7 pp., 1 fig.

In consequence of a destructive outbreak of *Laphygma frugiperda* (fall army-worm) in various parts of North Carolina in early September 1918, this circular was issued for distribution in time for the severe infestation expected in late September and early October. A brief popular account is given of the life-history and habits of the moth and various recommendations for control of the larvae are included [see this *Review,* Ser. A, v, pp. 174 & 386].

BALLOU (H. A.). **Cotton Stainer Control in St. Vincent.**—*Agric. News, Barbados,* xvii, no. 426, 24th August 1918, pp. 266–267.

An account of the extensive measures against the cotton stainer [*Dysdercus delauneyi*] in St. Vincent in 1918, shows the great need for co-operation between planters and the Government in the destruction of the food-plants of the insect, and the establishment of a close season, during which no cotton shall be grown.

In order that a close season may be a success, the law must be most strictly enforced, and at the appointed time all cotton must be removed from the fields and disposed of in the manner considered to be the most suitable. No compromise is possible, if the cotton industry is to be safeguarded, and this is also true of the destruction of the food-plants of the insect. It may be found necessary to attempt the eradication of *Ochroma lagopus* (cork wood), but at present *Sterculia caribaea* (mountain John Bull) is not equally important. The value of the destruction of alternative host-plants having been demonstrated, the exercise of constant care is necessary to prevent new growths of these plants, and to apply the provisions of the law to other plants as soon as they become important hosts.

Cotton-stainers are particularly free from natural enemies, and in the West Indies it is certain that there are none that can be expected to exercise any satisfactory degree of control over this pest.

FULLAWAY (D. T.). **Division of Entomology.**—*Hawaiian Forester & Agriculturist, Honolulu,* xv, no. 8, August 1918, pp. 235–236.

During the month of June the insectary handled 26,500 pupae of the melon fly [*Dacus cucurbitae*], from which were bred 2,346 individuals of *Opius fletcheri.* The parasites distributed were:—*Opius humilis,* 285; *O. fletcheri,* 2,391; *Diachasma tryoni,* 735; *Tetrastichus giffardianus,* 1,200; *Spalangia cameroni,* 4,200; and *Paranagrus osborni,* 20,800.

EHRHORN (E. M.). **Division of Plant Inspection.**—*Hawaiian Forester & Agriculturist, Honolulu,* xv, no. 8, August 1918, pp. 237–238.

During the month of June a case of plants from the mainland was fumigated for scale-insects and some maize from Mexico for an infestation of weevils and the Angoumois grain moth [*Sitotroga cerealella*].

HUNTER (W. D.). **The Pink Bollworm with Special Reference to Steps taken by the Department of Agriculture to prevent its Establishment in the United States.**—*U.S. Dept. Agric., Washington, D.C.,* Bull. no. 723, 30th August 1918, 26 pp., 10 figs.

This bulletin deals with the pink bollworm (*Pectinophora gossypiella*), its history, present range, description and life-cycle, together with a full account of the precautions taken to prevent its introduction into the United States.

In 1913 a quarantine was promulgated forbidding the importation of all species or varieties of cotton seed into the United States from any foreign locality except the Imperial Valley in the State of Lower California in Mexico, the importation from this region being covered by regulations. Later, the introduction of cotton seed from some of the northern states of Mexico was permitted. These quarantines against cotton seed, as such, were soon found to be insufficient, as considerable quantities of seed were being admitted in bales of lint. The destruction of infestation in bales of lint by means of cold was found to be impracticable, the use of heat being also impossible on account of the time necessary to penetrate the highly compressed bales, and the increased danger from fire on opening bales so heated. However by fumigation with hydrocyanic acid gas in vacuo it was found possible to kill any insects that might be within densely compressed bales of cotton without any deterioration of the latter. It having been discovered in 1915 that large amounts of cotton-waste were being imported, some of which contained more than twenty times as much seed as baled cotton, the definition of the term "cotton" was made to include all grades of cotton-waste except those resulting from processes which rendered the retention of seeds impossible.

Early in 1916 the fumigation of all bales of foreign cotton and cotton-waste was required as a condition of entry, and establishments capable of handling all imported cotton without special delay were erected at the ports of entry. The cargo of a steamer having been found to be heavily infested, the entire lot, consisting of 4,000 bags of seed, was converted into fertiliser by immersion in vats of sulphuric acid. In addition the holds of the vessel were thoroughly fumigated with hydrocyanic acid gas, all trucks, platforms, and floors thoroughly cleaned of scattered seeds, and cotton fields within a radius of 10 miles systematically inspected. Towards the end of 1916 an amendment was added providing for the inspection and, if necessary, disinfection of all burlaps or other fabrics used for covering cotton and to which cotton was adhering. Finally in 1917 an order restricting the admission of all cotton seed products, except oil, from all foreign countries was promulgated owing to the discovery that uncrushed, infected seeds often adhered to such products.

Owing to the disturbed conditions in Mexico, the presence of *P. gossypiella* there was not detected till the end of 1916, by which time a large amount of Mexican cotton seed had been shipped to mills in Texas. The State authorities in Texas were notified and the Federal Horticultural Board began a campaign to expedite the crushing of the seed and the destruction of any scattered about the premises. This work was done with the utmost possible dispatch and great thoroughness. The pest however had gained a footing in Texas, and active measures to eradicate it were undertaken by the Federal Horticultural Board in co-operation with the Department of Agriculture of the State of Texas. The work consisted in determining the limits of infestation, the destruction of any plants yet remaining in the fields, and the safeguarding of the cotton produced in these fields during the season of 1917. Plants in the fields were uprooted or chopped down, all locks or portions of locks on the ground were collected by hand, and all accumulated trash was burnt with the help of kerosene, an operation that employed 500 men from the beginning of November till the middle of March. Early in 1918 a proclamation was issued prohibiting the planting of cotton in certain quarantined areas of Texas.

Active steps towards the control of *P. gossypiella* have also been undertaken in Mexico, one of these being a quarantine against the main infested territory, with a provision for a safety zone of considerable depth. The other provides for the fumigation of all cotton seed produced, whether intended for crushing or planting.

FRACKER (S. B.). **White Grubs. Their Life-History and Control.**—*Wisconsin State Dept. Agric., Madison*, Circ. no. 11, April 1918, 4 pp., 4 figs. [Received 17th October 1918.]

The species of *Lachnosterna* breed and oviposit in grassland, lawns, meadows, and weedy fields, but not in cultivated fields or clover. Since the life-cycle occupies 3 years, in the one following oviposition the soil is heavily infested with the larvae. Such grassland should therefore not be ploughed and sown with maize or cultivated crops, but where convenient, pigs should be turned on to it to root out the grubs. Maize and cultivated crops should be planted only on land that was under clover or a cultivated crop the previous summer.

FRACKER (S. B.). **San José Scale, what it is and how to control it.**—*Wisconsin State Dept. Agric., Madison*, Circ. no. 10, March 1918, 4 pp., 2 figs.

The San José scale [*Aspidiotus perniciosus*] is not an important pest in the State of Wisconsin, but since it is easily introduced by means of infested nursery stock, and then spreads with the utmost rapidity, it should be controlled on its first appearance, either by the destruction of every tree and shrub infested, or by means of a dormant spray. The best solutions for this purpose are:—Lime-sulphur 1 gal., water 8 gals; Scalecide 1 gal., water 12 gals.; kerosene emulsion 1 gal., water 3½ gals.; any one of which should be applied after severe pruning, which is always desirable, and in the case of severely infested twigs, absolutely essential.

CHAPMAN (G. H.). **Mosaic Disease of Tobacco.**—*Mass. Agric. Expt. Sta., Amherst,* Bull. no. 175, May 1917, pp. 73–117, 6 plates. [Received 17th October 1918.]

The fact that many fungous and bacterial diseases are often transmitted by insects, as well as other agents, has been long known and thoroughly established, the mosaic disease of tobacco being carried by Aphids, especially *Macrosiphum tabaci*, Perg. [see this *Review*, Ser. A, i, p. 19, and v, p. 577]. Observations in the field have not shown that this disease is communicated by biting insects such as the tobacco horn-worm [*Protoparce quinquemaculata*], grasshoppers, and a flea-beetle, nor has it been possible to demonstrate positively that white-flies [*Aleurodes*] are active agents in the spread of the disease.

REGAN (W. S.). **Potato Plant Lice and their Control.**—*Mass. Agric. Expt. Sta., Amherst,* Bull. no. 177, October 1917, pp. 135–146. [Received 17th October 1918.]

Macrosiphum solanifolii, Ashm., is a pest of potatoes, the life-history of which has already been noticed [see this *Review*, Ser. A, iv, p. 133, and vi, p. 455].

The measures recommended against it are thorough spraying with an angle-disc or under-spray nozzle, using one of the following solutions: (1) Blackleaf 40 ½ U.S. pint, hard soap dissolved in boiling water 2 lb. (liquid soap, 1 U.S. quart) and water 50 U.S. gals. (2) Blackleaf 40, or any similar nicotine preparation, combined with lead arsenate or Bordeaux mixture, but without the addition of soap. (3) Kerosene emulsion made of hard soap ½ lb. (liquid soap, ½ U.S. pint), water 1 U.S. gal. and kerosene 2 U.S. gals.; this kills about 90 per cent. of the Aphids, but is liable to damage the foliage.

CLAASSEN (P. W.). **Grasshoppers of Kansas.—Systematic Treatise of the *Melanopli* with Reference to Variations from Scudder's Descriptions.**—*Univ. Kansas, Lawrence,* Biol. Ser. Bull., xviii, no. 1 (Dept. Entom. Bull. no. 11), October 1917, pp. 7–50, 2 plates. [Received 18th October 1918.]

The contents of this systematic paper are indicated by its title. The biology and economic status of the species of *Melanoplus* are briefly discussed. The most injurious species occurring in Kansas are *M. differentialis*, *M. bivittatus*, *M. atlantis*, *M. femur-rubrum* and *Aeolopus regalis*. The parasitic fly, *Sarcophaga kellyi*, is largely instrumental in reducing the numbers of these grasshoppers. The usual methods of control are advocated.

BEAMER (R.). **The Œdipodinae of Kansas.**—*Univ. Kansas, Lawrence,* Biol. Ser. Bull., xviii, no. 1 (Dept. Entom. Bull. no. 11), October 1917, pp. 53–126, 108 figs. [Received 18th October 1918.]

This paper forms the second part of a series dealing with the Orthoptera of Kansas, of which the preceding paper is the first. Descriptions are given which it is hoped may enable the casual observer to recognise the various species and the relation they bear to each other. The original descriptions are given wherever possible, with notes on the variation of Kansas forms and habitat records.

Owing to the disturbed conditions in Mexico, the presence of *P. gossypiella* there was not detected till the end of 1916, by which time a large amount of Mexican cotton seed had been shipped to mills in Texas. The State authorities in Texas were notified and the Federal Horticultural Board began a campaign to expedite the crushing of the seed and the destruction of any scattered about the premises. This work was done with the utmost possible dispatch and great thoroughness. The pest however had gained a footing in Texas, and active measures to eradicate it were undertaken by the Federal Horticultural Board in co-operation with the Department of Agriculture of the State of Texas. The work consisted in determining the limits of infestation, the destruction of any plants yet remaining in the fields, and the safeguarding of the cotton produced in these fields during the season of 1917. Plants in the fields were uprooted or chopped down, all locks or portions of locks on the ground were collected by hand, and all accumulated trash was burnt with the help of kerosene, an operation that employed 500 men from the beginning of November till the middle of March. Early in 1918 a proclamation was issued prohibiting the planting of cotton in certain quarantined areas of Texas.

Active steps towards the control of *P. gossypiella* have also been undertaken in Mexico, one of these being a quarantine against the main infested territory, with a provision for a safety zone of considerable depth. The other provides for the fumigation of all cotton seed produced, whether intended for crushing or planting.

FRACKER (S. B.). **White Grubs. Their Life-History and Control.**—*Wisconsin State Dept. Agric., Madison*, Circ. no. 11, April 1918, 4 pp., 4 figs. [Received 17th October 1918.]

The species of *Lachnosterna* breed and oviposit in grassland, lawns, meadows, and weedy fields, but not in cultivated fields or clover. Since the life-cycle occupies 3 years, in the one following oviposition the soil is heavily infested with the larvae. Such grassland should therefore not be ploughed and sown with maize or cultivated crops, but where convenient, pigs should be turned on to it to root out the grubs. Maize and cultivated crops should be planted only on land that was under clover or a cultivated crop the previous summer.

FRACKER (S. B.). **San José Scale, what it is and how to control it.**—*Wisconsin State Dept. Agric., Madison*, Circ. no. 10, March 1918 4 pp., 2 figs.

The San José scale [*Aspidiotus perniciosus*] is not an important pest in the State of Wisconsin, but since it is easily introduced by means of infested nursery stock, and then spreads with the utmost rapidity, it should be controlled on its first appearance, either by the destruction of every tree and shrub infested, or by means of a dormant spray. The best solutions for this purpose are:—Lime-sulphur 1 gal., water 8 gals; Scalecide 1 gal., water 12 gals.; kerosene emulsion 1 gal., water 3½ gals.; any one of which should be applied after severe pruning, which is always desirable, and in the case of severely infested twigs, absolutely essential.

Chapman (G. H.). **Mosaic Disease of Tobacco.**—*Mass. Agric. Expt. Sta., Amherst,* Bull. no. 175, May 1917, pp. 73–117, 6 plates. [Received 17th October 1918.]

The fact that many fungous and bacterial diseases are often transmitted by insects, as well as other agents, has been long known and thoroughly established, the mosaic disease of tobacco being carried by Aphids, especially *Macrosiphum tabaci*, Perg. [see this *Review*, Ser. A, i, p. 19, and v, p. 577]. Observations in the field have not shown that this disease is communicated by biting insects such as the tobacco horn-worm [*Protoparce quinquemaculata*], grasshoppers, and a flea-beetle, nor has it been possible to demonstrate positively that white-flies [*Aleurodes*] are active agents in the spread of the disease.

Regan (W. S.). **Potato Plant Lice and their Control.**—*Mass. Agric. Expt. Sta., Amherst,* Bull. no. 177, October 1917, pp. 135–146. [Received 17th October 1918.]

Macrosiphum solanifolii, Ashm., is a pest of potatoes, the life-history of which has already been noticed [see this *Review*, Ser. A, iv, p. 133, and vi, p. 455].

The measures recommended against it are thorough spraying with an angle-disc or under-spray nozzle, using one of the following solutions: (1) Blackleaf 40 ½ U.S. pint, hard soap dissolved in boiling water 2 lb. (liquid soap, 1 U.S. quart) and water 50 U.S. gals. (2) Blackleaf 40, or any similar nicotine preparation, combined with lead arsenate or Bordeaux mixture, but without the addition of soap. (3) Kerosene emulsion made of hard soap ½ lb. (liquid soap, ½ U.S. pint), water 1 U.S. gal. and kerosene 2 U.S. gals.; this kills about 90 per cent. of the Aphids, but is liable to damage the foliage.

Claassen (P. W.). **Grasshoppers of Kansas.—Systematic Treatise of the *Melanopli* with Reference to Variations from Scudder's Descriptions.**—*Univ. Kansas, Lawrence,* Biol. Ser. Bull., xviii, no. 1 (Dept. Entom. Bull. no. 11), October 1917, pp. 7–50, 2 plates. [Received 18th October 1918.]

The contents of this systematic paper are indicated by its title. The biology and economic status of the species of *Melanoplus* are briefly discussed. The most injurious species occurring in Kansas are *M. differentialis, M. bivittatus, M. atlantis, M. femur-rubrum* and *Aeolopus regalis.* The parasitic fly, *Sarcophaga kellyi*, is largely instrumental in reducing the numbers of these grasshoppers. The usual methods of control are advocated.

Beamer (R.). **The Œdipodinae of Kansas.**—*Univ. Kansas, Lawrence,* Biol. Ser. Bull., xviii, no. 1 (Dept. Entom. Bull. no. 11), October 1917, pp. 53–126, 103 figs. [Received 18th October 1918.]

This paper forms the second part of a series dealing with the Orthoptera of Kansas, of which the preceding paper is the first. Descriptions are given which it is hoped may enable the casual observer to recognise the various species and the relation they bear to each other. The original descriptions are given wherever possible, with notes on the variation of Kansas forms and habitat records.

Lawson (P. B.). **The Coccidae of Kansas.**—*Univ. Kansas, Lawrence,* Biol. Ser. Bull., xviii, no. 1 (Dept. Entom. Bull. no. 11). October 1917, pp. 161–275, 103 figs. [Received 18th October 1918.]

Of the 75 species of Coccids here dealt with, 12 are reported from Kansas for the first time. Two new species are described, namely, *Orthezia ambrosiae* and *Ceroplastodes deani.* The former was taken from the under-side of leaves of *Ambrosia trifida,* where they were first observed in June, adults being fairly abundant and immature forms much more so. By August the adults had become scarce and by September had disappeared. Hibernation evidently occurs in the nymphal stage; an undetermined Coccinellid has been observed feeding upon these hibernating forms early in the winter. *C. deani* was taken on *Petalostemon violaceus,* being abundant within a restricted area.

Wellhouse (W. H.). **The Cankerworm, an Orchard and Shade Tree Pest.**—*Univ. Kansas, Lawrence,* Biol. Ser. Bull., xviii, no. 1 (Dept Entom. Bull. no. 11), October 1917, pp. 282–315, 3 plates. [Received 18th October 1918.]

This paper deals with both the spring cankerworm, *Palaeacrita vernata,* Peck, and the autumn one, *Alsophila pometaria,* Harr. The life-history of both species is described. *P. vernata* emerges from the ground during the first warm days, sometimes as early as 5th January, and continues to do so until April. Eggs are laid in crevices in the bark and hatch in about four weeks. The larvae feed upon leaves, blossoms and fruit of their host-plant for about 3 to 5 weeks, during which period they moult three times. By about the end of May they have all left the trees and burrowed into the soil from 1½ to 6 inches to pupate, remaining there until the next winter. The life-history of *A. pometaria* is similar, but the adults emerge in November and December and the eggs remain over the winter, hatching in late April or early May. Both species have a variety of food-plants, including apple, elm, plum, cherry, and other fruit trees.

Wet weather during the adult and larval stages is the greatest natural check on cankerworms. A wilt disease often attacks the larvae following a period of wet weather. Birds are important enemies of all stages and destroy large numbers of them. Predaceous enemies include the Carabid beetles, *Calosoma scrutator* and *C. calidum,* and a wasp, *Eumenes fraterna,* Say, which carries the larvae away to its nest. A fly, *Microgaster palaeacritae,* is a common parasite of the larvae, about 10 per cent. of larvae examined by one worker being parasitised by it. A Tachinid has also been recorded as a parasite. The eggs are parasitised by a Chalcid, *Platygaster* sp. The remedial measures recommended are the banding of trees to prevent the wingless female moths from climbing them to oviposit, and spraying with 1¼ lb. powdered lead arsenate (or 2½ lb. paste) to 50 U.S. gals. water, applied as soon as the leaves have opened in spring, to kill the larvae. Blackleaf 40, 1 : 1,000 with 2 lb. soap to each 50 U.S. gals. of spray, is also recommended. Cultivation of the soil between July and November destroys the pupae of the spring species and is an excellent control measure in orchards.

VINAL (S. C.). **The Greenhouse Red Spider attacking Cucumbers and Methods for its Control.**—*Mass. Agric. Expt. Sta., Amherst*, Bull. no. 179, November 1917, pp. 153–182. [Received 17th October 1918.]

Tetranychus telarius (*bimaculatus*) is the most widely distributed and destructive pest of greenhouse cucumbers, assuming its greatest economic importance in the market-garden district of Boston. The greenhouse vegetables most subject to attack are cucumbers, egg-plants and tomatoes, many individual growers of the first of these estimating their annual losses at between £400 and £1,000.

Control of the pest on the plants by fumigation is impossible, but fumigation with sulphur dioxide is an inexpensive and efficient method of ridding an infested house of mites in the intervals between crops. Spraying with a strong stream of water, which efficiently controls the pest on certain plants such as carnation, violet and rose, is limited in its usefulness by the tenderness of the forcing-house cucumber foliage. An efficient adhesive spray may be made by boiling 8 lb. flour in 8 U.S. gals. water to form a paste, and diluting to form 100 U.S. gals. A solution of ordinary laundry starch is also recommended. An equally effective spray can be made by dissolving 1½ lb. ivory soap in 25 U.S. gals. water. The most satisfactory commercial insecticide is a completely saponified oil soap called lemon oil, containing:—soap 6 per cent., vegetable oil 3½ per cent., potassium carbonate 0·5 per cent., turpentine (terebenthine) 5 per cent., and water, not over 85 per cent. Used at the strength of 1 part in 20 parts of water, or 1 pint in 2½ U.S. gals. water, it killed all actively feeding and quiescent mites without injuring the foliage, but the eggs were not materially affected. A less expensive emulsion may be made by shaving 6 oz. ivory soap into 1 U.S. gal. hot water, adding 2 U.S. qts. cold water and 1 U.S. qt. linseed oil and emulsifying with a bucket pump; this, when used at the rate of 1 part in 9 parts water, is very efficient, killing quiescent and feeding mites without injuring the leaf-tissue. The effectiveness of raw linseed oil is partly due to its being a contact poison, but chiefly to its adhesiveness. Being composed of two types of oil, drying oil and resinous oil, it rapidly volatilises when applied as a film, leaving the resinous or waxy residue enveloping any mites present on the leaf. To effect a thorough control, at least three applications should be given to the young plants at weekly intervals, as soon after they have been set out in the greenhouses as possible, cool, cloudy days being chosen for the operation.

ESSIG (E. O.) & KUWANA (S. I.). **Some Japanese Aphididae.**—*Proc. California Acad. Sci., San Francisco*, viii, no. 3, 9th July 1918, pp. 35–112, 40 figs. [Received 2nd November 1918.]

This paper, which has been prepared as an introduction to the study of Japanese Aphids, includes the following species:—*Macrosiphum absinthi*, L., on *Artemis vulgaris indica*; *M. granarium*, Kirby, on rice; *M. hagi*, sp. n., on *Lespedeza bicolor* (hagi); *M. ibotum*, sp. n., on the under-sides of the leaves of *Ligustrum ibota*; *M. nipponicum*, sp. n.; *M. nishigaharae*, sp. n., on *Chrysanthemum*; *M. rosae*, L., on *Rosa multiflora*; *M. rudbeckiae*, Fitch, on *Boltonia indica*,

Cnicus japonicus and *Platycodon grandiflorum*; *Rhopalosiphum indicum*, Van der Goot, on *Euscaphis japonica* and *Staphylea bumalda*; *R. lactucae*, Kalt., on *Lactuca denticulata* and *Sonchus oleraceus*, L.; *R. lespedezae*, sp. n., on *Lespedeza bicolor*; *R. magnoliae*, sp. n., on *Poncirus trifoliata*, *Magnolia conspicua* and *Ipomoea hederacea*; *R. nymphaeae*, L., on *Prunus mume* (Japanese apricot), plum, Japanese pear, peach, *Sagittaria sagittaefolia* and East Indian lotus; *R. persicae*, Sulzer, on *Brassica campestris* (mustard); *Siphocoryne bicaudata*, sp. n., on *Salix* sp.; *S. japonica*, sp. n., on *Angelica polymorpha*; *Aphis avenae*, F., on *Hordeum vulgare* and wheat; *A. brassicae*, L., on *Brassica chinensis*; *A. citricola*, Van der Goot, on citrus; *A. gossypii*, Glover, on orange, cucumber, potato and other plants; *A. japonica*, sp. n., on apple; *A. medicaginis*, Koch, on *Vicia faba*, *Hibiscus syriacus*, etc.; *A. pomi*, De G., on *Chaenomeles japonica* (Japan quince), apple, and Japanese pear; *A. rumicis*, L., on *Rumex crispus*; *A. siphonella*, sp. n., on Japanese pear; *A. somei*, sp. n., on *Rhus javanica*, *Viburnum tomentosum*, apple, orange, and Japanese pear; *A. spinulosa*, sp. n., on cherry; *A. thalictrii*, sp. n., on *Thalictrum minus*; *Toxoptera aurantii*, Boyer, on *Illicium anisatum*; *T. piricola*, Mats., from pseudogalls on edges of Japanese pear leaves; *Chaitophorus japonica*, sp. n., on *Acer pictum*; *C. salijaponica*, sp. n., on *Salix multinervis*; *Calaphis magnoliae*, sp. n., on *Magnolia kobus*; *Euceraphis japonica*, sp. n., on *Alnus indica glauca*; *Myzocallis capitata*, sp. n., on *Quercus serrata*; *M. macrotuberculata*, sp. n., on *Quercus dentata*; *M.* (*Nippocallis*) *kuricola*, Mats., on *Castanea sativa*; *Chromaphis celticolens*, sp. n., on *Celtis sinensis*; *Trichosiphum kuwanai*, Perg., on *Quercus serrata*; *Eutrichosiphum pasaniae*, Okajima, on *Castanopsis cuspidata*; *Lachnus pinidensiflorae*, sp. n., on *Pinus densiflora* (Japanese red pine); *Pterochlorus tropicalis*, Van der Goot (*japonicus*, Mats.), on *Quercus serrata*, *Q. dentata*, and *Castanopsis cuspidata*; *Prociphilus crataegi*, Tullg., on *Crataegus cuneatus*; *P. osmanthae*, sp. n., on *Osmanthus aquifolium*; *P. pyri*, Fitch, from pseudogalls on Japanese pear leaves; *Anoecia* (*Nippolachnus*) *piri*, Mats., on pear leaves; *Nipponaphis distylii*, Perg., from leaf-galls on *Distylium racemosum*; and *N. cuspidatae*, sp. n., on *Castanopsis cuspidata*.

BRÈTHES (J.). **La Polilla de los Graneros.** [Granary Pests.]—*Anales Soc. Rural Argentina, Buenos Aires*, lii, no. 6, June 1918, pp. 339–342, 2 figs. [Received 21st October 1918.]

The most destructive granary pest in South America is *Calandra oryzae*, which has four generations in a year, or five if the winter is warm. A less important pest is *Tinea granella*, which attacks exclusively wheat, barley and rye. The appearance and habits of these pests are described. Fumigation is recommended with carbon bisulphide, carbon tetrachloride or sulphurous anhydride. In the case of the last-named, $5\frac{1}{4}$ oz. of sulphur are mixed with $3\frac{1}{2}$ oz. of saltpetre; the mixture is ignited and allowed to burn for 24 hours, the granary being hermetically sealed during the operation. It is then thoroughly ventilated, and the walls, roof, etc. disinfected with a 2 per thousand solution of corrosive sublimate. The quantities given are sufficient to fumigate 50 cubic metres (1,766 cubic feet).

BARBER (H. S.). U.S. Bur. Entom. **Notes and Descriptions of some Orchid Weevils.**—*Proc. Entom. Soc. Washington, D.C.*, xix, no. 1–4; March, June, September, December, 1917; pp. 12–22, 1 plate. [Received 22nd October 1918.]

Several weevils injuring orchids are dealt with in this paper and descriptions are given of the following new species: *Acythopeus gilvonotatus*, found among Phillipine orchids in Washington greenhouses and on *Phalaenopsis* in New Jersey; *Eucactophagus weissi*, taken in orchid houses in New Jersey; and *E. biocellatus* from a single specimen received from the Canal Zone, Panama.

WALTON (W. R.). U.S. Bur. Entom. **Three New Tachinid Parasites of *Eleodes*.**—*Proc. Entom. Soc., Washington, D.C.*, xix, no. 1–4; March, June, September, December 1917; pp. 22–26, 1 plate. [Received 22nd October 1918.]

The new species of Tachinids here described, which are parasitic upon adult Coleoptera, include *Eleodiphaga caffreyi*, gen. et sp. nov., from adults of *Eleodes extricata*, Say, in New Mexico, and *E. obsoleta*, Say in Arizona; *Eleodiphaga pollinosa*, reared from an adult of *Eleodes hispilabrus*, Say, in New Mexico; and *Biomyia eleodivora*, described from one individual reared from an adult of *Eleodes tricostata*, Say, in Nebraska.

HALL (W. B.). **Notes on the Immature Stages of *Hemitaxonus multicinctus*, Rohwer.**—*Proc. Entom. Soc., Washington, D.C.*, xix, no. 1–4; March, June, September, December, 1917; p. 28. [Received 22nd October 1918.]

The sawfly, *Hemitaxonus multicinctus*, Rohwer, is recorded from cultivated ferns, *Athyrium thelypteroides*, in Ohio. The eggs are laid late in May on the upper side of the leaf, incubation varying from 50 to 60 hours. In rearing cages the feeding stage of the larvae occupied 11 to 12 days. There is only one annual generation. It seems probable that this species is only partly controlled by hellebore. The house wren, *Troglodytes domesticus*, is an active enemy of the larvae.

CUSHMAN (R. A.). U.S. Bur. Entom. **Two new Chalcids from the Seeds of *Amelanchier*.**—*Proc. Entom. Soc., Washington, D.C.*, xix, no. 1–4; March, June, September, December, 1917; pp. 79–86, 1 plate. [Received 22nd October 1918.]

The discovery of two species of Chalcid developing in the seeds of the shad bush (*Amelanchier canadensis*) was recorded by the author in 1914; since then, a number of infested berries have been collected and examined. Descriptions are given of the two species reared from the berries, both of which are new to science. *Megastigmus amelanchieris*, sp. n., described from seeds collected in West Virginia and in Pennsylvania, oviposits in late May and early June, the egg probably being deposited within the tissue of the seed. The larva

entirely consumes the contents of the seed and matures in early July, by which time the fruit is ripening and falling to the ground. The larva hibernates within the seed, pupates in the following spring, and the adult emerges a few days later. The life-cycle therefore occupies nearly a year.

Syntomaspis amelanchieris, sp. n., appears as an adult from two to three weeks later than *M. amelanchieris*, when the berries are nearly full-grown, oviposition occurring in the latter part of June. The results of rearing experiments lead to the suspicion that *Syntomaspis amelanchieris* is parasitic on *Megastigmus amelanchieris*, and this is borne out by the fact that examination of a seed showed traces of both species, an adult of *S. amelanchieris* emerging, while a dead and shrivelled larva of *M. amelanchieris* remained within the seed. Whether *S. amelanchieris* is normally parasitic is not definitely known, but the later emergence of this species, together with its comparative rarity and the condition of the seeds at the time the adults are active, all indicate that such is the case.

BURKE (H. E.). U.S. Bur. Entom. ***Oryssus* is Parasitic.**—*Proc. Entom. Soc., Washington, D.C.*, xix, no. 1–4; March, June, September, December, 1917; pp. 87–89. [Received 22nd October 1918.]

Observations made during the past two years have definitely confirmed the supposition that the members of the genus *Oryssus* are parasitic, several species of Buprestids having proved to be its hosts. Many instances of parasitism are recorded, including a larva found near a larva of *Buprestis aurulenta*, L., in the outer wood of Douglas spruce; a larva that developed into an adult of *Oryssus occidentalis*, parasitising a larva of *Buprestis confluens*, Say, in an old log of aspen (*Populus tremuloides*); *O. occidentalis* parasitising *Buprestis laeviventris* in old logs of yellow pine (*Pinus ponderosa*). A pupa of the genus *Oryssus* was also found in the same logs in what appeared to be the pupal cell of the Buprestid, *Chrysophana placida*. The act of oviposition into a Buprestid larval mine in yellow pine was witnessed. The length of the life-cycle of the parasite is not yet determined. The larvae have as yet been found only with large Buprestid larvae and it is not known whether they are internal feeders in the small Buprestid larvae or whether they only attack the host larvae when well developed. The larvae of the genus *Buprestis* which serve as hosts live for several years in the wood of the host plant.

ROHWER (S. A.) & CUSHMAN (R. A.). U.S. Bur. Entom. ***Idiogastra*, a new Sub-order of Hymenoptera, with Notes on the Immature Stages of *Oryssus*.**—*Proc. Entom. Soc., Washington, D.C.*, xix, no. 1–4; March, June, September, December, 1917; pp. 89–98, 2 plates. [Received 22nd October 1918.]

In view of the discovery of the habits of larvae of *Oryssus occidentalis* [see preceding paper], the authors suggest that the Oryssoids should be raised to the rank of a sub-order, *Idiogastra*. The larva and pupa of *O. occidentalis* are described.

CUSHMAN (R. A.). U.S. Bur. Entom. **Notes on the Biology of** ***Schizonotus sieboldi*****, Ratz.**—*Proc. Entom. Soc., Washington, D.C.*, xix, no. 1–4; March, June, September, December, 1917; pp. 128–129, 1 plate. [Received 22nd October 1918.]

The case of Chalcids feeding as external parasites of their host, unprotected by their food-substance or pupal covering, has been very rarely observed, though the Eulophid, *Euplectrus comstocki*, How., is well-known as having this habit in relation to the cotton worm [*Alabama argillacea*]. Another Chalcid with similar habits is *Schizonotus sieboldi*, Ratz., which was originally described from individuals reared from *Melasoma* (*Chrysomela*) *populi*. The author records the attack of this parasite upon pupae of *M. interruptum*, Hald., on alder in Pennsylvania. Both larvae and pupae of the parasites were found on the ventral side of the host; there were generally 3 to 7 parasites on each, the beetle pupa being sucked until completely dry. On pupae of *M. interruptum* that had been parasitised by successive attacks of *S. sieboldi*, the minute larvae of the second attack were found feeding on the older parasites.

HEINRICH (C.). U.S. Bur. Entom. **A New** ***Coleophora*** **injurious to Apple in California.**—*Proc. Entom. Soc., Washington, D.C.*, xix, no. 1–4; March, June, September, December, 1917; pp. 135–136. [Received 22nd October 1918.]

Coleophora volckei, sp. n., is described from moths reared from larvae collected in California upon apple, the larvae mining the leaves and occasionally feeding upon the fruit itself [see this *Review*, Ser. A, vi, p. 99].

ROHWER (S. A.). U.S. Bur. Entom. **The American Species of the Genus** ***Cephus*****, Latreille.**—*Proc. Entom. Soc., Washington, D.C.*, xix, no. 1–4; March, June, September, December, 1917; pp. 139–141. [Received 22nd October 1918.]

This paper is the result of a study of many individuals of the genus *Cephus* reared from the stems of various grass-like plants, and is an attempt to separate the species that are injurious to American cereal and forage crops. The author has come to the conclusion that there is only one species involved, the forms previously distinguished being merely extreme varieties of the same species. A key is given to the North American species of *Cephus*, in which the European species, *C. pygmaeus*, L., is differentiated from the native American one, *C. cinctus*, Norton. The latter has the more extended range and is of far more economic importance in North America. The species previously known as *Cephus rufiventris*, Cress., is referred to the genus *Janus*.

FISHER (W. S.). U.S. Bur. Entom. **A New Species of Longhorn Beetle infesting Cowpeas from Mexico.**—*Proc. Entom. Soc., Washington, D.C.*, xix, no. 1–4; March, June, September, December, 1917: pp. 173–174. [Received 22nd October 1918.]

Lepturges spermophagus, sp. n., is described from four individuals reared from unripened seeds in the green pods of cowpeas; it closely

resembles the common American *Leptostylus macula*, Say. The only other Longicorn beetle recorded as infesting leguminous plants is *Baryssinus leguminicola*, Linell, a single individual of which was taken from a jar containing pods of *Enterolobium*, from Paraguay.

MIDDLETON (W.). U.S. Bur. Entom. **Notes on the Larvae of some Cephidae.**—*Proc. Entom. Soc., Washington, D.C.*, xix, no. 1–4; March, June, September, December, 1917; pp. 174–179, 1 plate. [Received 22nd October 1918.]

This paper is the first of a series on North American sawfly larvae. Five species representing four genera of Cephids are here dealt with, with a key differentiating the larvae. *Adirus trimaculatus*, Say, is recorded as boring in blackberries and roses. *Janus abbreviatus*, Say, infests willow and poplar; from the material collected, *Tetrastichus* sp., *Eurytoma* sp. and *Microbracon* sp. emerged. *J. integer*, Norton, agreeing with the larval description of *J. abbreviatus*, was found boring in *Ribes* sp. (currant) in Massachusetts; during the rearing experiments, three undetermined Chalcids emerged. *Cephus cinctus*, Norton, was obtained from *Elymus canadensis*; and *Hartigia cressoni*, Kirby, from *Rubus* in California.

WESTGATE (J. M.). **Report of the Hawaii Agricultural Experiment Station, 1917.**—*States Relations Service, U.S. Dept. Agric., Washington, D.C.*, 5th March 1918, 56 pp., 8 plates. [Received 22nd October 1918.]

Adoretus umbrosus (Japanese beetle) is one of the most important insect pests of grapes, particularly in restricted areas. As the beetles hide under the soil during the day, band-picking of the adults at night when the insects can be seen on the foliage by means of a lantern has proved the most effective measure, though it is tedious and expensive. Experiments with arsenical sprays on grape-vines gave good results; 1 lb. paste lead arsenate in a very adhesive form to 10 U.S. gals. water proved the best of several formulae tried. During wet weather a fungus disease was a factor of some importance in controlling this beetle. *Dacus cucurbitae* (melon fly) is a great menace to tomato growing in Hawaii; it is hoped by hybridisation to secure a strain resistant to the pest. A mite is found associated with a very prevalent and destructive disease of potatoes, the new terminal growth and the petioles becoming withered and dried, and the plants dying in 10 to 20 days if seriously attacked. Whether the mites are actually the cause of the disease is not known. *Peregrinus maidis* (corn leaf-hopper) caused great destruction in a field of maize grown for variety and fertiliser tests. A large number of parasites (*Ootetrastichus* sp.) were released among the maize and succeeded in controlling the leaf-hoppers sufficiently for a crop to be obtained.

DAWSON (J. H.). **Kumara Culture.**—*New Zealand Jl. Agric., Wellington, N.Z.*, xvii, no. 2, 20th August 1918, pp. 84–86.

The sweet potato (*Ipomoea batatas*) is becoming every year a more important article of food in New Zealand, partly no doubt on account of the failure of much of the potato crop during the past three seasons.

The plant is particularly free from diseases or pests; the only pest observed is the caterpillar of *Herse* (*Sphinx*) *convolvuli*. This moth is not yet sufficiently abundant to require controlling other than by hand-picking the conspicuous larvae.

ESAM (G.). **Orchard Sprays and Spraying.**—*New Zealand Jl. Agric., Wellington*, xvii, no. 2, 20th August 1918, pp. 103–109.

This paper discusses the merits of various types of spraying apparatus and gives general directions for spraying during the various seasons for the commoner pests of apples, pears and stone fruits. In the author's opinion unnecessary risk is taken in fruit-growing, particularly in regard to sprays and spraying; he contends that fruit-growers should be prepared for the worst possible weather conditions, should select the best spray for their purpose and should not stint its use.

FRANKLIN (H. J.). **Report of the Cranberry Substation for 1916.**—*Mass. Agric. Expt. Sta., Amherst*, Bull. no. 180, November 1917, pp. 183-234. [Received 17th October 1918.]

Rhabdopterus picipes, Oliv. (cranberry rootworm) was definitely identified by breeding during the year. The larvae, which are nearly full-grown at the beginning of winter, hibernate in this stage and pupate in June, the chief period of emergence of the adult being from the 3rd to the 11th July. To protect the foliage from the beetles, it was experimentally sprayed on the 3rd, 11th and 18th July with an arsenical spray composed of Corona lead arsenate $2\frac{1}{4}$ lb., white arsenic 1 heaped teaspoonful, and water 40 U.S. gals. In the last application the arsenic was increased to $1\frac{1}{2}$ teaspoonfuls. Observations continued till the end of the season showed that the pest had been practically exterminated by this treatment.

Experiments and observations of bog-flooding operations against the larvae of *Lymantria* (*Porthetria*) *dispar*, L., show that these will be most satisfactory if done while the caterpillars are small, and the sooner after the eggs are hatched the better. Very young larvae have the habit of clinging to their support when submerged and are less liable to float ashore alive. To be entirely effective, even when the larvae are small, a flood must be maintained for nearly 40 hours. An account of the dispersion of the larvae by wind has already been noticed [see this *Review*, Ser. A, p. 215].

The larvae of the last brood of *Perrisia* (*Dasyneura*) *vaccinii*, Smith (cranberry tip worm) were found to be parasitised by one Chalcidid (*Tetrastichus* sp.) and two Proctotrupids (*Aphanogmus* sp. and *Ceraphora* sp.), the first two being present only in small numbers, but the last forming a heavy infestation, the chief emergence of the adults taking place between the 12th and 22nd August.

Rhopobota vacciniana, Pack. (black-head fireworm) was successfully controlled in the larval stage with Black-leaf 40, 1 part to 400 parts water, resin-fish-oil soap being added at the rate of 2lb. to 50 U. S. gals. Further experiments with this insecticide are needed to determine at what strength, and how many times, it should be applied to

either brood. Two or perhaps three applications for the first brood are necessary, but for the second brood lead arsenate may probably prove more suitable, as it is less injurious to tender foliage.

Mineola vaccinii, Riley (cranberry fruit worm) was less prevalent in 1916 than in any season since 1903. This moth is not usually very troublesome except in regions with comparatively cold and dry climates. The eggs are parasitised by the Chalcidid, *Trichogramma minutum*, and the larvae by the Braconid, *Phanerotoma franklini*, and by *Pristomeridia agilis*, parasitised cocoons being usually much smaller and more delicate than the normal ones. The results of submergence tests conducted with fruit worms in their cocoons showed that the effects depend largely upon the temperature of the water, and it is suggested that a flooding after picking, if begun before 1st October and continued for 12 or possibly even 10 days, might control this pest as well as late holding of the winter flood usually does. Such flooding practised annually after picking would probably also have a much less harmful effect on the bog.

A destructive outbreak of *Laphygma frugiperda*, S. & A. (fall army worm), on widely separated cranberry bogs in New Jersey occurred in 1916, following closely, and evidently caused by, the removal of winter-flowage in mid-July. This moth, which feeds on a variety of plants, has not hitherto been known as a cranberry pest, and as its frequent outbreaks, which start in the southern States, sometimes reach as far north as Canada, there is reason to fear that the mid-summer removal of winter-flowage may more or less regularly invite serious trouble from this pest on Cape Cod, as well as in New Jersey.

VINAL (S. C.). **The European Corn Borer, *Pyrausta nubilalis*, Hübner, a Recently Established Pest in Massachusetts.**—*Mass. Agric. Expt. Sta., Amherst*, Bull. no. 178, December 1917, pp. 147–152. [Received 17th October 1918.]

Pyrausta nubilalis (European corn borer) although introduced into Massachusetts only about 8 years ago, now infests a district about 100 square miles in extent. At present sweet maize is the only valuable commercial crop seriously attacked, the other food-plants, *i.e.*, hops, hemp and millet, not being grown in the infested region. The most commonly infested weeds and grasses are barnyard grass (*Echinochloa crusgalli*), pig weed (*Amarantus retroflexus*) and foxtail grass (*Setaria glauca*); dahlia stems are also injured.

Since all the transformations take place within the plant, there is no hope of destroying the pest by the use of insecticides during summer, and measures must be directed against the hibernating insects. This may be effected by burning the stalks, which, however, is a wasteful method as they are valuable both as fodder and as green manure. Burying them, provided that they are cut into small pieces with a disc harrow and then deeply ploughed in, is effective if done thoroughly. The best means from an economic point of view is that of using the stalks for fodder, but they must be shredded when used either green or dry. Ensilage by ordinary methods must be a highly effective method of destroying the insects, since it seems very improbable that they could survive the conditions existing in a silo.

SANDERS (J. G.) & FRACKER (S. B.). **Division of Entomology.**—*Biennial Rept. Wisconsin Dept. Agric. for the Years 1915–1916, Madison*, Bull. no. 10, 31st December 1916, pp. 30–56. [Received 17th October 1918.]

Of the 162 nurseries inspected during 1915, 74 were reported entirely clean, and the remainder showed only common and unimportant diseases and insect pests, the most serious being the San José scale [*Aspidiotus perniciosus*] present in 9 nurseries. All the infested trees were destroyed, as well as those discovered during a second inspection after the leaves had fallen. In 1916 this scale was found in only 4 nurseries and in limited numbers, these infested trees being also destroyed. Since the San José scale was first discovered in Wisconsin about 1896 and again in 1902, it has been imported into the State a great many times, 35 separate introductions into 15 different localities having been discovered and the host-plants destroyed. In the case of the 6 towns where it is now strongly established, it is probable that there have been repeated introductions. In all cases where the pest is present in, or adjacent to, commercial orchards it will be drastically eliminated, since its presence in an orchard increases the cost of production by at least 8 to 15 per cent.

Cryptorrhynchus lapathi (imported poplar weevil) was a serious pest, over 5,000 poplar and willow trees being condemned or destroyed by inspectors during the summer of 1916. Although known in Wisconsin for less than a decade, it has spread throughout the State, and special interest attaches to the possibility of finding varieties of poplar that are relatively immune. The life-cycle of *C. lapathi* occupies an entire year, eggs being laid after 15th July, on which date the adult beetles begin to appear. The larvae hatch out in a few days and may be found in the bark and sapwood during the late summer, autumn and winter. The principal injury is caused to the woody fibres of the tree, the latter being also greatly weakened by the autumn feeding in the sapwood, so that it may be broken off easily by accident or a strong wind.

Lachnosterna spp. (white grubs) are relatively more injurious in Wisconsin than in the neighbouring States, though they are serious pests throughout the entire Mississippi valley. An account of their occurrence in Wisconsin has already been noticed [see this *Review*, Ser. A, iv, p. 283].

Grasshoppers, including *Melanoplus atlantis* and other species, probably cause as much damage annually as all other insects combined. An alarming outbreak in 1914 was dealt with by the use of a poisoned bran mash and a poison spray with beneficial results. The formula for the preparation of the former was:—Bran 20 lb., Paris green 1 lb., syrup 2 U.S. qts., 3 lemons, water $3\frac{1}{2}$ U.S. gals., this quantity being sufficient for 5 acres; and the formula for the latter was:—Sodium arsenite 1 lb., syrup 2 U.S. qts., water 60 U.S. gals.

Hylemyia antiqua, L., (onion maggot), which has caused immense damage throughout the country for many years has been successfully controlled by the use of a poison-bait spray consisting of $\frac{1}{4}$ oz. sodium arsenite or white arsenic dissolved in 1 U.S. gal. boiling water to which $\frac{1}{2}$ pint to 1 pint black New Orleans molasses has been added, the bait being made much more attractive by soaking chopped onions

in it for a time. This should be applied by sprinkling with a whisk broom or coarse hand sprayer twice a week from the time the onions first appear, until the middle of June.

Pulvinaria vitis, L. (cottony maple scale) has been increasing in numbers for 3 or 4 years, and does not seem to be so rapidly controlled by insect enemies as formerly. Communal action in the purchase of high pressure spraying outfits, ladders and trucks is the most practicable method of control.

Schreckensteinia festaliella, Hb., a European species that has been recorded from blackberries in Virginia, caused a great amount of damage to raspberries in 1915 and 1916, though a rational spraying system would probably result in its elimination.

An orchid weevil, *Cholus cattleyae*, Champ. (*cattleyarum*, Barber) probably has a life-cycle occupying from 6 months to a year. Adults have been taken in January, March, June, August and September, larvae having also been found in all stages during this time. The pupal period occupies from two to four weeks.

Phytomyza (*Napomyza*) *chrysanthemi*, Kowartz (chrysanthemum leaf-miner) is often a source of considerable loss to florists. Black-leaf 40, with or without whale-oil soap, using 1 part of 40 per cent. nicotine to 400 of water, is a satisfactory control for it.

Memoria de los Trabajos realizados contra la Langosta: Invasión del 1915-1916. [Memorandum of Work carried out against Locusts: Invasion of 1915–1916.]—*Defensa Agrícola, Repub. Oriental del Uruguay, Ministerio Industrias, Montevideo*, 1916, 444 pp., with maps and illustrations. [Received 17th October 1918.]

This review of the locust invasion of 1915–1916, one of the most serious ever experienced in Uruguay, describes the methods adopted to control it. The locusts of this outbreak appeared to be particularly free from diseases. In many localities the swarms were attacked by a parasite, *Mermis acridiorum*, but apparently with but little effect on their intensity or voracity. Although the invasion was not completely controlled throughout the localities attacked, it was considerably checked by means of vigorous and co-operative action in the face of many difficulties, such as lack of labour and materials. The character of much of the country invaded, which was uninhabited and full of shelter for the locusts, rendered control more difficult, while in the more populated regions the measures carried out met with much more success. As a preliminary measure, all available machinery and materials were collected, including large quantities of galvanised iron, many cases of naphtha, torches, insecticides, potash soap etc. All available labour was utilised, including military help, and the materials were distributed throughout the invaded territory. Wherever possible the eggs were destroyed by digging up the fields where they were deposited, but in the case of roads, or other places where removal was not practicable the campaign was directed against the adults. Drags were found to be the most useful apparatus for the destruction of the adults, while fencing war indispensable in controlling the hoppers. The most widely adopted measure was that of fencing and ditching, this plan

proving the most efficacious and economical. In other cases the locusts were driven into corrals constructed of low iron fencing and were then burnt or treated with some insecticide.

The reports of the inspectors in the various districts are appended, with details of the measures adopted, which varied according to the conditions in the different localities.

ADAIR (E. W.). **Additional Notes on some Egyptian Cerambycidae mentioned in Mr. Alfieri's List.** (Bull. 1916, 3. 1917.)—*Bull. Soc. Entom. d'Egypte, Cairo*, x, no. 3, July-September, 1917, pp. 96–97. [Received 22nd October 1918.]

As regards the Cerambycids mentioned by Alfieri [see this *Review*, Ser. A, v, p. 293], *Macrotoma palmata*, F., should be noted as feeding upon *Eucalyptus* and not camphor, which is very rare in the neighbourhood of Cairo. *Dichostates subocellatus*, Fairm., is found in the trunks and branches of *Poinciana regia*. The larvae of *Pseudoalbana lameerei*, Pic, have been observed attacking the stems of *Citrullus vulgaris* var. *colocynthoides* in Nubia at the end of March. Adults emerged in the middle of April. In the fruit of the same plant were found large numbers of *Baris granulipennis*, which has hitherto been recorded in Egypt only in the fruit of *Citrullus colocynthis*.

MOSSÉRI (V. M.). **Les Cotons Egyptiens, leur Détérioration et les Moyens d'y remédier.** [Egyptian Cotton, its Deterioration and Remedial Measures.]—*Bull. Union Agriculteurs d'Egypte, Cairo*, xvi, no. 124, August-September 1918, pp. 53–79.

The increase of *Pectinophora* (*Gelechia*) *gossypiella* (pink bollworm) on Egyptian cotton has been ascribed to a growing degeneracy in the cotton plants that has rendered them more liable to insect attack, Investigations carried on for several years have however led to the conclusion that no type of cotton at present grown in Egypt, whether old or new, pure or impure, offers any specific resistance to the attacks of the pink bollworm. It is known that in India *P. gossypiella* is an enemy of secondary importance to cotton. But whenever an attempt has been made to introduce the Egyptian varieties these have been heavily attacked, while the Indian varieties cultivated in the vicinity have scarcely suffered at all. It is obvious then that a selection based on the question of immunity to pink bollworm attack would be a distinct advantage in the planting of cotton. This is a recognised method of control in dealing with certain vegetable pests and it is hoped that by patient and intelligent experiment on the part of experts the problem of the control of *P. gossypiella* may some day be solved by this method.

CARPENTER (C. W.). **Methods of Combating Garden Pests.**—*Hawaii Agric. Expt. Sta., Honolulu*, Exten. Bull. no. 4, Emer. Ser. ii, 13th August 1917, 16 pp. [Received 22nd October 1918.]

This bulletin gives information of practical value in checking the ravages of insect and fungus pests in gardens in the Hawaiian Islands. A table is given of the crops, pests, signs of disease, and methods of control advocated. Formulae and instructions are given

for the preparation of the most commonly used insecticides and spray mixtures, and dips for disinfecting seeds; methods of fumigating infested cereals, etc., are discussed in connection with the various groups of insects to which they apply.

Problems of Wheat Storage.—*Commonwealth Australia Advisory Council Sci. Indust., Melbourne,* Bull. no. 5, 1917, pp. 19–23. [Received 22nd October 1918.]

A preliminary notice of this report has already appeared [see this *Review,* Ser. A, vi, p. 269]. The Progress Report of the Special Committee that has been considering the damage done to stored grain by insects discusses the development of weevils in wheat and the increase in the number of weevils; the destruction of weevils by means of poisonous gases and by drying; and favourable and unfavourable conditions for the multiplication of grain weevils. Points that still require elucidation are the percentage of moisture in samples of harvested grain from all the chief grain-producing districts of the Commonwealth, and the degree and rate of absorption of moisture from the air of moist climates by dry grain completely protected from rain, but freely exposed to air. It is suggested that the experiments made by F. J. Cole on the effects of moisture and carbon dioxide on the rate of multiplication of grain weevils should be repeated and amplified under Australian conditions.

Brittain (W. H.). **Sucking Insects of the Apple.**—*Fifty-second Ann. Rept. Nova Scotia Fruit Growers' Assoc. for 1916, Port Williams,* 1916, pp. 85–111. [Received 22nd October 1918.]

This paper reviews the life-histories, habits and methods of control of the most injurious sucking insects that attack apples in Nova Scotia. The species dealt with include *Lygus communis novascotiensis* (green apple bug) [see this *Review,* Ser. A, iv, pp. 96 & 520 and v, p. 191]. Other species of which some account is given include *Aphis sorbi,* Kalt. (rosy apple aphis), *Aphis pomi,* DeG. (green apple aphis), *Eriosoma lanigerum,* Hausm. (woolly apple aphis), various scale-insects, and *Eriophyes pyri* (pear-leaf blister mite), all of which have been dealt with in this *Review.*

Sanders (G. E.). **Results obtained at the Dominion Entomological Laboratory during 1915.**—*Fifty-second Ann. Rept. Nova Scotia Fruit Growers' Assoc. for 1916, Port Williams,* 1916, pp. 112–129. [Received 22nd October 1918.]

Recurvaria nanella, Hb. (lesser bud-moth) which was first recorded from Nova Scotia in 1915, is similar in life-history and habits to other species of bud-moths common in Nova Scotia, but differs in the effect that the odour of sulphur sprays has upon it. Almost complete control can be obtained by a late dormant or semi-dormant lime-sulphur or soluble sulphur spray. Such a spray does not seem to kill any larvae in their hibernating quarters, but when they emerge in the spring the odour of these sprays causes them to drop to the ground instead of attacking the opening buds. This species is a serious pest in Europe on apple, pear, plum and peach, and as it has been

imported into Canada without its native parasites it may prove a very injurious pest in the future. *Nygmia phaeorrhoea*, Don. (brown-tail moth), the cankerworm and the tussock moth are also dealt with in respect to their prevalence during the year under review.

BLAIR (W. S.). **Experimental Orchard Work-1915.** — *Fifty-second Ann. Rept. Nova Scotia Fruit Growers' Assoc. for 1916, Port Williams*, 1916, pp. 184–197.

This paper records the results of many experiments with various sprays and indicates the value of spraying on certain dates.

MURPHY (P.). **Apple Dusting in Nova Scotia.**—*Fifty-third Ann. Rept. Nova Scotia Fruit Growers' Assoc. for 1917, Port Williams*, 1917, pp. 44–50. [Received 22nd October 1918.]

This paper records the first experiments in dusting apples in Nova Scotia. The results indicate that dusting is undoubtedly a superior method to lime-sulphur spraying, and it is thought that the former method will be largely employed as soon as it has been proved successful in controlling apple scab under Nova Scotia conditions at all seasons.

DUNSTAN (A. G.). **Some Injurious Biting Insects in Nova Scotia.**—*Fifty-third Ann. Rept. Nova Scotia Fruit Growers' Assoc. for 1917, Port Williams*, pp. 61–67. [Received 22nd October 1918.]

Some figures are given illustrating the steady decrease in the numbers of *Nygmia phaeorrhoea* (brown-tail moth). Other species dealt with are *Ametastegia glabrata* (dock sawfly) [see this *Review*, Ser. A, v, p. 241], *Ancylis nubeculana* (leaf-sewer) [see this *Review*, Ser. A, v, p. 106], the tussock moth and cankerworm.

BRITTAIN (W. H.). **Experimental Results in 1916.**—*Fifty-third Ann. Rept. Nova Scotia Fruit Growers' Assoc. for 1917, Port Williams*, pp. 68–80. [Received 22nd October 1918.]

Tables are given showing the results of experiments against the green apple bug [*Lygus communis novascotiensis*] and detailed recommendations for control measures are included. Miscellaneous spraying tests are also recorded with tables showing the results.

SANDERS (G. E.). **Some Results from Spraying Work of 1916.**—*Fifty-third Ann. Rept. Nova Scotia Fruit Growers' Assoc. for 1917, Port Williams*, pp. 160–177.

A number of spraying experiments are recorded. The spraying recommendations given have previously been noticed [see this *Review*, Ser. A, v, p. 176].

BRITTAIN (W. H.). **Some Miscellaneous Results in 1917.**—*Fifty-fourth Ann. Rept. Nova Scotia Fruit Growers' Assoc. for 1918, Port Williams*, 1918, pp. 27–39. [Received 22nd October 1918.]

The question of dusting *versus* spraying is discussed, chiefly with regard to apple scab infestation. The work in connection with green

apple bug [*Lygus communis novascotiensis*] has been continued and former observations confirmed; in particular the importance of the spray before blossoming is emphasised, the material used being soluble sulphur, soap and Blackleaf 40. Cankerworms were also well controlled by this mixture. Experiments with poison sprays against potato beetles showed that calcium arsenate is the cheapest effective poison; it is, however, less adhesive than lead arsenate or zinc arsenate.

MURPHY (P.). **Comparison of Dusting and Spraying Apples in Nova Scotia in 1917.**—*Fifty-fourth Ann. Rept. Nova Scotia Fruit Growers' Assoc. for 1918, Port Williams,* 1918, pp. 58-71. [Received 22nd October 1918.]

Results in dusting apples have been rather conflicting in the year under review, and some years' trial will be necessary before its general utility is definitely assured. A mixture of 90 per cent. sulphur and 10 per cent. lead arsenate was found superior to weaker mixtures, the results being shown in a table, particularly as regards insect control, but the protection afforded by the dust against apple scab is not as good as the spray provides. A table compares the results in 1916 and 1917. Another table emphasises the harmless nature of dusting as regards injury to foliage and the dropping of fruit, while the applications can be made with far greater rapidity than is the case with a liquid spray. On the other hand, the excessive cost of dusting materials at present limits the use of this method.

SANDERS (G. E.). **Apple Spraying.**—*Fifty-fourth Ann. Rept. Nova Scotia Fruit Growers' Assoc. for 1918, Port Williams,* 1918, pp. 72-92.

The value of lime-sulphur as a spray for apples is discussed, with the injury it causes to the fruit, the best methods of applying the spray, the periods at which the spray is dangerous to the fruit and the effect of sunlight on lime-sulphur injury. It is found that soluble sulphur and calcium arsenate cannot be used for four sprays as the lime causes yellowing. A mixture of 1 lb. soluble sulphur, 10 lb. hydrated lime and $\frac{1}{2}$ lb. calcium arsenate to 40 gals., added in the order named, may be used four times on the most tender foliage without injury. Some suggestions are given for experimenting with this spray alternating with various Bordeaux mixtures. With soluble sulphur, calcium arsenate is the only poison that can be used, while with Bordeaux mixture calcium arsenate is satisfactory and cheap. For the outbreak of cankerworm existing in many orchards, especially where tanglefoot has not been applied, the only way to prevent defoliation is to spray thoroughly just before the blossoms open with 15 lb. paste lead arsenate to 100 gals. water. For the tussock moth [*Hemerocampa leucostigma*], which was abundant in 1917 and is expected to do still greater damage in 1918, the third or after-blossom spray was found to be more effective than the fourth, particularly with the addition of a poison. The author strongly advocates the use of the spray gun as a labour-saving device.

PIKE (M. P.). **Dominion Experimental Orchard Work in 1917.**—*Fifty-fourth Ann. Rept. Nova Scotia Fruit Growers' Assoc. for 1918, Port Williams*, 1918, pp. 145–166.

The value of various sprays is discussed, chiefly with regard to the control of apple scab. From results obtained during the past four years it is evident that lime-sulphur arsenate is a more satisfactory spray than Bordeaux arsenate. Lead arsenate has been found the most efficient insecticide to use with lime-sulphur. Heavy applications of lime-sulphur arsenate are likely to cause scorching; the lighter the application the less scalding will result. Scorching of the foliage may be due to lime-sulphur only, but the addition of an arsenate increases the damage; yellowing of the foliage is apparently due entirely to the arsenate and not to the lime-sulphur. Foliage injury has appeared principally after the fourth spray, and Bordeaux arsenate in this connection seems to cause as much injury as lime-sulphur arsenate. It is thought that more attention should be given to sprays applied before blooming and that the strength of 1 to 40 lime-sulphur in these sprays can be made without danger of foliage injury if reasonable applications are given. If only one spray is applied before blossoming, it should be given just when the pink of the blossoms becomes apparent. The spray after the petals have fallen should be weaker, about 1 to 50 strength of lime-sulphur. The fourth spray should not be a drench spray, but should be as lightly applied and misty as possible, using 1 : 50 or 1 : 60 strength.

SCAMMEL (H. B.). **Cranberry Insect Problems and Suggestions for solving them.**—*U. S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 860, December 1917, 45 pp., 38 figs. [Received 29th October 1918.]

Cranberry insects can be disposed of with little difficulty where there is an abundant water supply, permitting flooding and re-flooding at the proper times, and when the sites of new bogs are to be chosen this should be borne in mind. Where the supply of water is insufficient other measures for insect control must be resorted to. Foliage-attacking insects include *Rhopobota vacciniana*, Pack. (blackhead fireworm). The eggs of this species are deposited in July and August on the under-side of cranberry leaves, and may hatch as early as 20th April on dry bogs. Deep flowage and heavy vine growth delay the time of hatching. Eggs of the second generation appear in late June or early July. Reflowing when properly timed has proved the best control measure. Flowage should be applied when the larvae are about full-grown; in the pupal stage 4 days' reflowage is required to exterminate them. The water must be kept just over the tips and any exposed tips must be mown or burnt. Recommendations for spraying as given in this bulletin are quoted elsewhere [see this *Review*, Ser. A, vi, p. 553]. *Peronea minuta*, Rob. (yellow-head fireworm) is frequently troublesome in New Jersey, but is of minor importance at present in other cranberry regions. The larvae of both the above species make webs joining the terminal leaves and buds together, beneath which they feed. The second generation of larvae, as well as attacking the leaves, eat the blossoms and bore into the newly developed berries. *P. minuta* may have at least

four generations in New Jersey, though three is the normal number. The last generation infests the fruit to a considerable extent in September and October. This species can be controlled by holding the winter flowage in one season until 10th May. The wintering moths are then compelled to oviposit on the uplands and the larvae seldom return to the bogs. Lead arsenate, at the strength of 3 to 5 lb. paste to 50 U.S. gals. water, is recommended as a spray for newly-hatched larvae. It is suggested also that on dry bogs two sprays should be given at intervals of a week just before new leaves appear at the tips, using 40 per cent. nicotine sulphate (1 : 800) at the rate of 200 U.S. gals. per acre. *Gelechia trialbamaculella*, Cham. (red-striped fireworm) is found almost invariably with infestations of *P. minuta* and is a dry-bog species. The winter is passed in the larval stage, in a narrow tubular case among badly distorted leaves. Adults emerge from these cases in May, a second generation of adults appearing in July and early August. Bogs that can be covered by winter flowage are not troubled by this moth. Lead arsenate (3 lb. paste to 50 U.S. gals. water) should control the pest when present on the vines in mid-August. *Perrisia* (*Dasyneura*) *vaccinii*, Smith (cranberry tipworm) has caused serious losses in Massachusetts and is becoming very injurious in New Jersey; in Wisconsin it has been long established and has recently been recorded on the Pacific coast. Winter is passed in the larval stage on the ground and thus winter flowage has little effect on this species. Damage by the larvae is first noticed in May and June, the later generation, occurring in July, being much more injurious. In both instances the topmost leaves are attacked, become cupped and break off. New growth is speedily attacked by the second generation, and few buds are formed, so that no fruit develops on the uprights in the succeeding year. In Massachusetts infestation can be reduced to a minimum by sanding the bog lightly every other year. In New Jersey a much heavier sanding would be required, covering all the litter beneath the vines at least half an inch. Spanworms are sometimes injurious on the vines and can be controlled by lead arsenate or Paris green. *Cirphis unipuncta*, Haw. (army worm) and *Laphygma frugiperda*, S. & A. (fall army-worm) attack cranberry plants in years of unusual abundance; a prompt reflowage, preferably during cloudy weather, will kill or drive the insects to the shore where they can be destroyed by burning kerosene. Poison-bait or arsenical sprays might be used where reflowage is impossible. *Systena frontalis*, F. (cranberry flea-beetle) generally attacks new plants, skeletonising the leaves. The beetles first appear in early July and remain throughout the summer. Oviposition occurs in late July, just below the surface of the ground. These eggs hatch in the following May. Young plantings sprayed with Bordeaux mixture, with the addition of 3 lb. lead arsenate paste or $1\frac{1}{2}$ lb. powder to 50 U.S. gals., are seldom attacked by the beetles.

Fruit-attacking insects include *Mineola vaccinii*, Riley (cranberry fruitworm), which is probably the most troublesome cranberry pest in Massachusetts and Wisconsin, while in New Jersey it is of minor importance. The larva upon hatching burrows into the fruit near the stem, closing the hole with a thin silken web. The seeds are eaten and some of the pulp, after which the berry is left for another. Upon completing its feeding the larva descends to the sand under

the vines and pupates, hibernation beginning in August, surviving the winter flowage and continuing until the following June or July, when the adult emerges. The eggs are usually laid in the calyx cup under the lobes, or on any part of the berry. Spraying with arsenicals has given little success in the control of this species. Studies in flowage treatment have previously been recorded [see this *Review*, Ser. A, iv, p. 486, and vi, p. 554]. *Epiglaea apiata*, Grote (cranberry blossom worm) is a recently discovered cranberry pest in New Jersey, and has not been recorded as a pest from other cranberry sections. Eggs are laid in autumn on litter beneath the vines, the larvae appearing in late May and early June. Feeding is at first confined to the leaves and later the buds are bored into, thus spoiling them for fruit production. After feeding throughout the summer, pupation occurs in early September in litter or in an earthen cell just below the surface of the ground. Adults appear in late September and October. As a control for the larvae, a heavy application of calcium arsenite on 30th June was very effective, but proved somewhat dangerous to the vines; a safer treatment is with 3 lb. lead arsenate paste or 1½ lb. powder to 50 U.S. gals. water, with the addition of 2 lb. resin-fish-oil soap. When feasible, much good may result from flooding the bog for one week immediately after picking the crop. If the water is applied in October, when the adults have emerged from the ground and are resting on the vines, the flood will destroy large numbers of them. Autumn flooding probably destroys the pupae also. If reflowage can be applied in June for 48 hours many of the worms will be destroyed. *Scudderia texensis*, S. & P. (cranberry katydid) ruins a large amount of fruit on the New Jersey bogs in its efforts to obtain the seeds of growing berries. Young katydids first appear on the bogs about mid-June and attain their full size in August, eggs being laid on blades of grasses in September or October, which survive the winter. Flooding the bogs in winter does not kill the eggs, but as these are laid on grasses, preferably double-seeded millet (*Panicum viscidum*) or deer grass (*Panicum dichotomum*), neither of these grasses should be allowed to grow on the bogs or along the dams. For clearing dams of grasses a form of torch delivering a spray of burning kerosene is found effective. Grasshoppers, particularly *Schistocerca alutacea*, Harr., and *Melanoplus bivittatus*, Say, and crickets destroy many berries. The former oviposit in the stems of sedges, rushes and large grasses, the latter in sandy dams or sandy patches in the bogs. Cleaner culture is desirable on bogs so infested, in some cases complete flooding out lasting two years is necessary, in others holding of the winter flowage until mid-July will destroy many objectionable weeds. The usual grasshopper poison-bait is also useful in the control of these species.

Vine-attacking insects include *Crambus hortuellus*, Hb. (cranberry girdler), which has recently been dealt with [see this *Review*, Ser. A, vi, p. 10]; *Phylloscelis atra*, Germ. (toad bug) [see this *Review*, Ser. A, ii, p. 455]; *Amphiscepa bivitta*, Say (vine-hopper) [see this *Review*, Ser. A, vi, p. 110], and minor stem feeders, including *Clastoptera proteus*, Fitch (cranberry froghopper), *Pseudococcus adonidum*, L. (mealy bug) and various scale-insects, such as *Aspidiotus ancylus*, Putnam, and *Lepidosaphes ulmi*, L.

Root-attacking insects include ***Rhabdopterus picipes***, Oliv. (cranberry root-worm) [see this *Review*, Ser. A, iii, p. 672 and vi, p. 553] and white grubs, including ***Phytalus georgianus***, Horn, ***Dyscinetus trachypygus***, Burm., and ***Lachnosterna grandis***, Sm., which are found occasionally in cranberry bogs, but are not of much importance. For infestations of small areas it is advisable to take up vines and turf on the infested areas and plant new vines. For larger areas, holding the winter flowage until 15th July would probably rid the bog of grubs.

FEYTAUD (J.). **Les Tenthrèdes du Poirier.** [Pear-tree Sawflies.]—*Bull. Soc. Etude Vulg. Zool. Agric., Bordeaux,* xvii, nos. 9–10, September–October 1918, pp. 102–103.

The life-histories of, and injuries due to, the larvae of *Neurotoma (Lyda) flaviventris*, Retz., and *Eriocampoides limacina*, Retz., have already been noticed [see this *Review*, Ser. A, ii, p. 478]. They are both parasitised by various Ichneumonids, the former chiefly by *Ophion mercator*, F., and the latter by *Mesoleius excavatus*, Prov., and *Tryphon translucens*, Ratz.

STAHL (C. F.) & CARSNER (E.). **Obtaining Beet Leaf-hoppers non-virulent as to Curly-top. (Preliminary Paper.)**—*Jl. Agric. Research, Washington, D.C.*, xiv, no. 9, 26th August 1918, pp. 393-394.

A method of obtaining non-virulent leaf-hoppers with certainty and relative ease has been evolved from tests conducted to verify earlier conclusions as to the infectivity of leaf-hoppers [see this *Review*, Ser. A, v, p. 492]. This consists in removing the young nymph from a diseased to a healthy plant before it has had an opportunity to feed, a proceeding rendered possible by the manner in which the egg of the leaf-hopper hatches. The eggs are laid mainly in the petioles of the leaves, and in hatching the nymph forces its way, anterior end first, from the egg-case and through the slit made by the ovipositor. When the body of the insect reaches a position more or less perpendicular to the plant surface the appendages begin to unfold, and during the latter part of this operation the nymph may be lifted off and transferred to a healthy plant by means of a small camel's-hair brush.

In the first experiment, begun on 19th April 1915, three lots of nymphs, numbering 7, 9, and 15 individuals, respectively, were transferred as they hatched to three healthy beet plants in separate cages, the insects being left on the plants until after they had become adults. All three plants remained healthy. On 3rd July the insects of two of the lots were caged on two separate plants affected with curly-top. After 17 days they were again caged on two healthy plants, both of which developed the disease.

These and similar results show conclusively that uninfected insects placed on healthy beet plants will not produce curly-top. Their special interest lies in the possibility of obtaining a supply of leaf-hoppers known positively to be non-virulent, which may be used to determine whether or not plants other than beets harbour the virus of curly-top.

URICH (F. W.). **Some of the Principal Insects affecting Vegetables in Trinidad and Tobago.**—*Bull. Dept. Agric. Trinidad & Tobago, Port-of-Spain,* xvii, no. 2, 1918, pp. 77–87. [Received 26th October 1918.]

These notes, prepared for the guidance of vegetable growers, deal with:—(1) Agricultural operations which tend to keep down insect pests; (2) natural enemies; (3) insecticides for biting and for sucking insects; (4) some of the principal insects of vegetables, grouped under the crops affected, and mentioning the part of the plant attacked and the nature of the damage, together with the necessary treatment and the best time for applying it.

Report of the Director.—*Twenty-eighth Ann. Rept. Agric. Expt. Sta. New Mexico Coll. Agric. & Mechanic Arts, State College, Las Cruces.* 1916–1917, 92 pp., 12 figs. [Received 29th October 1918.]

Experimental applications of lime-sulphur sprays on apples and pears against the San José scale [*Aspidiotus perniciosus*] seemed to indicate that an effective dormant spray might be applied later in the season than was formerly supposed. Local infestations of *Murgantia histrionica* (harlequin cabbage bug) were not severe enough to warrant any extensive remedial measures. There were two generations in the year, approximately 150 eggs being laid per female in a period of 4 to 6 weeks. Decisive results were obtained by the use of Blackleaf 40 against melon aphis [*A. gossypii*]. Grasshoppers did an unusual amount of damage in certain sections, and *Toxoptera graminum* (wheat aphis) occasioned great damage in the wheat sections on account of the backward spring. A local, but acute, infestation of *Eriophyes pyri* (leaf blister mite) was reported from New Mexico. A leaf-mining fly, *Agromyza scutellata*, Fall., did considerable damage in the spring of 1917 to early potatoes and beans, the infestation being noticeably reduced by spraying with Blackleaf 40, 1 : 400, powdered lead arsenate being added at the rate of 2 lb. to 50 U.S. gals. *Agromyza pusilla* (alfalfa leaf-miner) was very abundant at the same time. *Monoxia puncticollis*, var. *erosa* was generally distributed on sugar-beet fields in one district, but the damage was not serious. *Eutettix tenella* (sugar-beet leaf-hopper) was noted in connection with the bacterial disease, curly leaf, in a good many fields. Investigations on the life-history of the codling moth [*Cydia pomonella*] were continued and a spraying schedule was worked out for 1917, based on data previously collected. However, because of the very late spring, which retarded the blooming of fruit trees about a week and the emergence of moths about two weeks, it became necessary to make a corresponding change in the schedule.

GILLETTE (C. P.). **Some Grass-Root Aphids (Hem., Hom.).**—*Entom. News, Philadelphia,* xxix, no. 8, October 1918, pp. 281–284, 1 plate.

At Fort Collins, in Colorado, the alate forms of *Forda formicaria*, Heyden, (*Rhizoterus vacca*, Hart., *Tychea graminis*, Koch, *Forda occidentalis*, Hart.) begin to appear about 10th June and to migrate from the grass roots. At the end of about 4–6 weeks, the entire colony becomes winged and leaves the host-plant, apparently to seek others of the same sort; at least, the insects are found later in the

season upon grass roots again, where they remain all the winter, and they have not been taken upon other plants. The alate form has been taken from 2nd June to 12th July on the roots of *Melica bulbosa*, *Poa pratensis*, *Phleum alpinum*, and *Elymus* sp., in Colorado.

Forda olivacea, Roh., is by far the more abundant of the two species in Colorado, and does considerable damage to grasses and grain every year. It is a very general feeder among the grasses, being most common on isolated clumps along the roadside, the borders of fields and upon ditch banks. The species attacked are chiefly *Hordeum* (squirrel-tail grass), the *Agropyron* spp. (wheat grasses) and Kentucky blue grass. It has also been taken on wheat, oats, barley, timothy grass, *Bromus inermis*, *B. tectorum* and *Elymus* spp.

Ballou (H. A.). **Spread of the Mexican Cotton Boll Weevil in the United States.**—*Agric. News, Barbados,* xvii, no. 428, 21st September 1918, p. 298.

Discussing an account published by the United States Department of Agriculture on the present situation with regard to the cotton boll weevil [*Anthonomus grandis*] and its spread during recent years, the author remarks that it is of great interest to cotton growers in the West Indies to note that for a period of twenty-five years the Mexican boll weevil has spread steadily through the cotton belt of the southern States at an average rate of more than 15,000 square miles each year, that the Sea Island cotton districts of Georgia and Florida are invaded, and that the pest has reached South Carolina and at the end of 1917 threatened the Sea Island cotton district of that State. The output of Sea Island cotton from those States is bound to suffer a reduction and it is pointed out that, in view of the high cost of production, growers of this class of cotton are likely to turn their attention to the substitution of a more profitable crop. In that case the West Indian cotton growers will be in an increasingly strong position, and it becomes more than ever a matter of national importance to protect the cotton industry throughout the Islands. It is pointed out that *A. grandis* has within a period of 25 years spread over an area of nearly 500,000 square miles and in a few years more will infest the whole of the cotton belt (some 600,000 square miles). This steady spread has been in the face of strenuous exertions to check its increase. The pink bollworm [*Pectinophora gossypiella*] has also made extraordinary progress in the past few years and is a pest difficult to control and probably impossible to eradicate. The importation of cotton seed into the Islands from North, South or Central America or any other part of the West Indies is considered dangerous on account of these two pests and is prohibited in most of the West Indian cotton-growing islands. Every help should be given in enforcing the regulations for combating the known cotton pests and for preventing the importation of others.

Glaser (R. W.). **The Polyhedral Virus of Insects, with a Theoretical Consideration of Filterable Viruses generally.**—*Science, Lancaster, Pa.*, xlviii, no. 1238, 20th September 1918, pp. 301–302.

The wilt or polyhedral disease affecting so many different species of insects is not produced by bacteria, but is caused by minute

organisms capable of passing through diatomaceous filters. In a large series of passage infections 25 caterpillars of the gipsy moth [*Lymantria dispar*] were infected at a dilution of 1:1,000 with material obtained from a caterpillar previously dead of wilt. All these caterpillars died of typical wilt within 2 or 3 weeks, while 25 other caterpillars fed with the sterilised filtrate lived, pupated, and transformed into moths. Second, third and fourth passage infections were performed and the results were similar, except that the period from infection to death was considerably shorter at the fourth passage than at the first three, this shortening of time seeming to point to an increase in virulence with successive passages. Comparison of these results with those of other workers on the 32 or 33 disease-causing filterable viruses known, leads to the conclusion that the organism of wilt disease is a parasitic ultra-microscopic form, the nature of which, whether animal or vegetable, is not at present known.

MARLATT (C. L.). **The Origin of the Pink Bollworm.**—*Science, Lancaster, Pa.*, xlviii, no. 1239, 27th September 1918, pp. 309-312.

The determination of the original habitat of *Pectinophora gossypiella*, Saunders (pink bollworm) is of great interest in relation to the present distribution of this insect, and may be of importance later, as indicating where parasitic or other natural checks may be found.

Examination of the records strongly supports the theory that the insect originated in Southern Asia, probably India. The material from which the original descriptions were made by Saunders in 1842, was sent by the superintendent of the Government Cotton Plantations at Broach (Baruch) in Western India, accompanied by the information that it was very destructive to American cotton grown on light alluvial soil, but that the cotton on the black soil was not touched by it. He added that native cotton was sometimes affected by it, thus implying that it was a known but comparatively unimportant enemy of such cotton in India prior to 1842. The hardy and rather unproductive cottons of India and other southern Asiatic countries, probably long associated with this insect, evidently were then, and are still, fairly resistant to its attacks; while the introduced American and Egyptian varieties, being less so, furnish exceptional breeding conditions and are much more seriously attacked, thus bringing into prominence an insect which had previously been for the most part overlooked. Saunders at the time made no suggestion that the insect was other than a native Indian species, or that it was imported with the American cotton.

Support for a theory of possible American or at least African origin is based on the fact that the only near relative of the pink bollworm, *P. malvella*, Z., is known from Africa as well as southern Europe; but this is an unimportant point, since more accurate knowledge of the distribution of this species may show it to have a more extended range throughout southern Asia. Again, it may be urged against the view that this insect is of African origin that records, most of them antedating from 8 to 70 years the first report of its occurrence in Egypt, indicate its wide distribution throughout southern Asia, including Ceylon, India, Burma, Straits Settlements, Philippines, Japan (?) and Hawaii. The record of the cotton crop in Egypt up to

and subsequent to the first recognition of the pink bollworm in 1911 certainly gives no support to the theory of Egyptian origin. On the other hand, the evidence of its recent entry into Egypt is circumstantial and practically determined, both as to time and place of introduction, namely, in large importations of imperfectly ginned cotton or seed cotton from India in 1906 and 1907, this being distributed to towns near Alexandria for ginning, in which district the pink bollworm first appeared.

If the natural range of this insect extended to Africa it must have been limited to equatorial Africa, and certainly prior to 1906 or 1907 it had not reached the cultivated district of the Nile Valley, where cotton has been an important crop commercially for at least a hundred years.

GLASER (R. W.). **A New Bacterial Disease of Gipsy Moth Caterpillars.**—*Jl. Agric. Research, Washington, D.C.*, xiii, no. 10, 3rd June 1918, pp. 515–522, 1 plate. [Received 31st October 1918.]

A new infectious disease has been recorded as occurring in certain cultures of the Japanese race of the gipsy moth, *Lymantria* (*Porthetria*) *dispar*, L., and has also spread to cultures of the American race. The disease proves to be entirely distinct from wilt disease, the causative agent being a streptococcus which is new to science and is described in this paper under the name *Streptococcus disparis.* This bacterium enters the alimentary tract of the caterpillars with ingested food; during the later stages of the disease and after death it invades practically all the tissues. *S. disparis* is not pathogenic to silkworms (*Bombyx mori*, L.) nor to army worms (*Cirphis unipuncta*, Haw.), nor to human beings, guinea pigs, or rabbits. The disease was successfully reproduced in the field on several occasions; in two places quite a severe epidemic was created.

WOGLUM (R. S.). **Fumigation of Citrus Trees.**—*U. S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 923, March 1918, 30 pp., 17 figs. [Received 29th October 1918.]

This bulletin contains a general account of the approved methods of fumigating citrus trees with hydrocyanic-acid gas to control scale-insects and whiteflies. It deals with methods of procedure, necessary equipment, chemicals and the effect of the gas on insects and plants, and includes dosage schedules to be employed for the control of the various common citrus pests.

DAVIS (J. J.). **Common White Grubs.**—*U. S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 940, May 1918, 28 pp., 21 figs. [Received 29th October 1918.]

This is a revised edition of a previous bulletin [see this *Review*, Ser. A, ii, p. 121]. In addition to the information contained in the earlier issue, further parasites of white grubs are enumerated, including the larvae of *Microphthalma disjuncta*, Wied., and *Ptilodexia tibialis*, Desv., and the flies, *Cryptomeigenia theutis*, Wlk., *Eutrixa exile*, Coq., and *Biomyia lachnosternae*, Towns., which oviposit on the adult beetles when they are feeding at night. The larvae of the robber fly, *Promachus vertebratus*, are predaceous upon the white grubs. The value of white grubs and May beetles as animal food and as manure is discussed.

ERRATA.

Page 9	line 27	for "*anastassi*"	read "*anastasii.*"
" 25	" 5	" "*cummingi*"	" "*cumingi.*"
" 35	" 49	" "*dictyopermi*"	" "*dictyospermi.*"
" 50	" 31	" "Bostychid"	" "Bostrychid."
" 52	" 32	" "*Conchyloctaenia*"	" "*Conchyloctenia.*"
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" 86	" 16	" "*tuna*"	" "*toona.*"
" 95	" 4	" "*T. fuscaria*"	" "*J. fuscaria.*"
" 100	" 45	" "*Ceraputo*"	" "*Ceroputo.*"
" 119	" 32	" "*stellis*"	" "*stellio.*"
" 131	" 47	" "*Monachamus*"	" "*Monochamus.*"
" 143	" 23	" "*phoeorrhoea*"	" "*phaeorrhoea.*"
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" 172	" 7	" "*Rynchites*"	" "*Rhynchites.*"
" 175	" 49	" "*axylidis*"	" "*axyridis.*"
" 257	" 46	" "*Syphocoryne*"	" "*Siphocoryne.*"
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" 274	" 33	" "xxxix"	" "xxix."
" 300	" 10 & 17	for "Austin"	" "College Station."
" 305	" 12	for "oranges"	" "lemons."
" 314	" 45	" "*Xyleborus fornicatus* (shot-hole borer beetle)"	read "Chrysomelid beetles."
" 341	" 3	" "arsenite"	read "arsenate."
" 346	" 28	" "No. 1, January"	" "No. 2, February."
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